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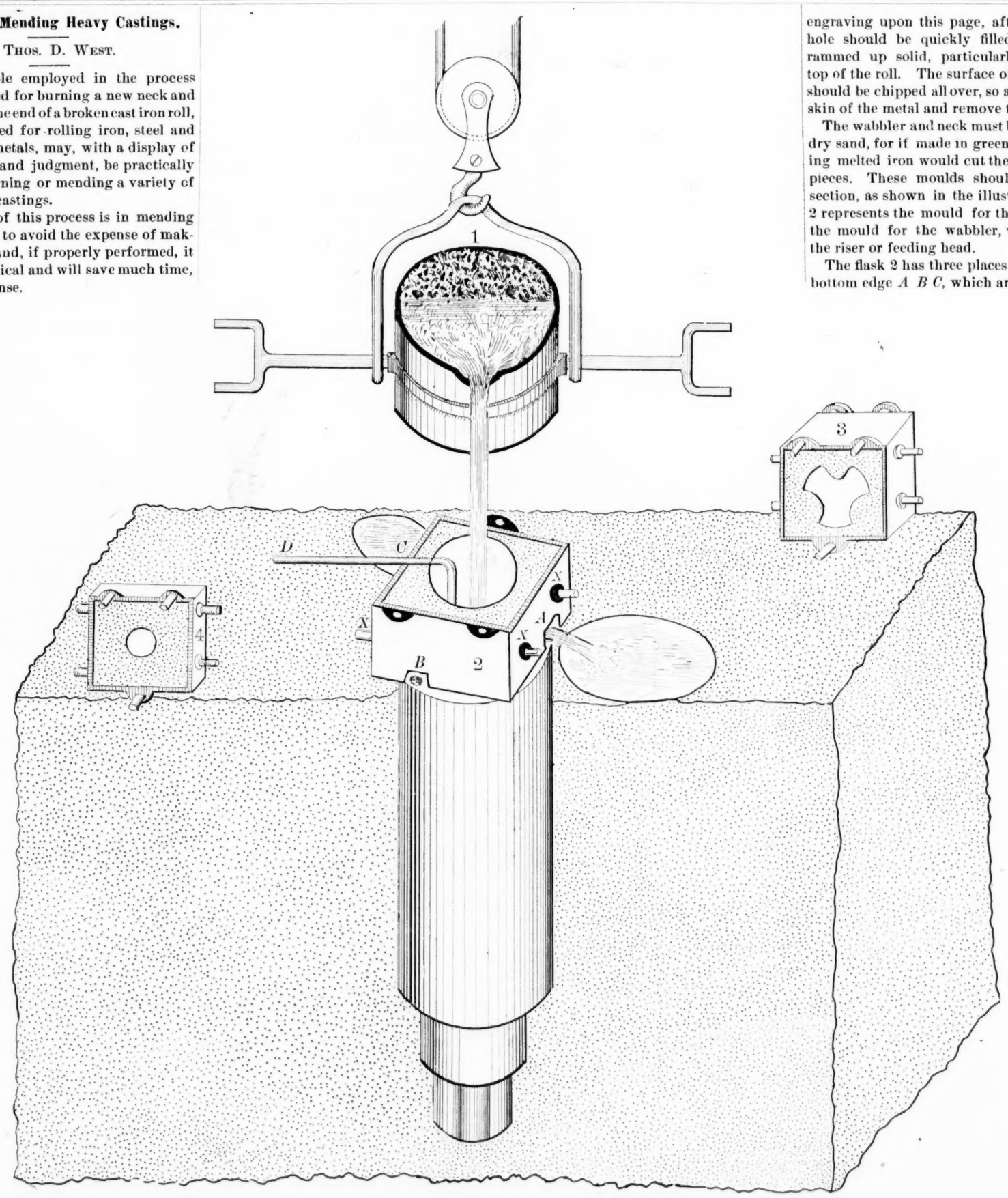
Burning or Mending Heavy Castings.

BY THOS. D. WEST.

The principle employed in the process herein described for burning a new neck and wabbler upon the end of a broken cast iron roll, such as are used for rolling iron, steel and other ductile metals, may, with a display of moderate skill and judgment, be practically applied for burning or mending a variety of heavy broken castings.

The object of this process is in mending heavy castings to avoid the expense of making new ones, and, if properly performed, it is very economical and will save much time, labor and expense.



PROCESS OF MENDING HEAVY CASTINGS.

The most essential points to be observed in mending heavy castings by this process, are as follows: The melted iron must be very hot and of a medium soft quality, for the hard iron chills quickly, and therefore does not perfectly cement or unite with the broken surface of the casting.

An outlet must be provided to allow the melted iron to escape from the mould as soon as it is poured in, particularly at first, as the hot metal is liable to chill. The hot metal should fall directly upon the surface of the fracture, and, after beginning to pour, a uniform steady cutting stream of iron should be kept flowing from an elevation as high as possible. In burning the neck and wabbler upon a roll, the larger the roll the more successful will be the operation, on account of the larger surface for the melted iron to burn or cut into, thus uniting more perfectly.

As a preliminary operation, the roll should be made as hot as possible in the foundry oven, after which it should be lowered into a hole, previously dug in the foundry floor, keeping the broken end even with the level of the floor, as shown in the engraving upon this page, after which the hole should be quickly filled with sand, rammed up solid, particularly around the top of the roll. The surface of the fracture should be chipped all over, so as to break the skin of the metal and remove the rust.

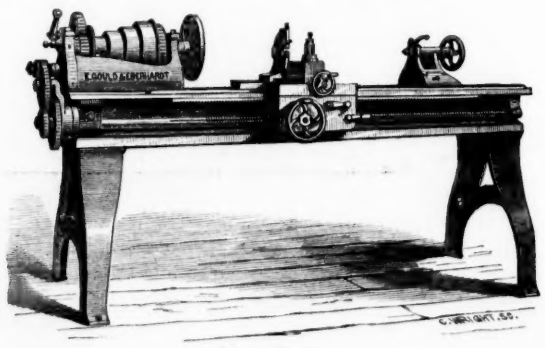
The wabbler and neck must be moulded in dry sand, for if made in green sand the falling melted iron would cut the moulds all to pieces. These moulds should be made in section, as shown in the illustration, where 2 represents the mould for the neck, and 3 the mould for the wabbler, while 4 is for the riser or feeding head.

The flask 2 has three places cut out at the bottom edge *A B C*, which are for openings to allow the melted iron to freely escape while the neck is being burnt on. As soon as the roll has been securely placed, the flask 2 should be put in position, care being observed to keep the opening for the neck exactly in the center of the roll to allow for turning up the journal in a lathe. Pigs of iron or other suitable heavy weights should be placed upon the handles *X X*, to hold down

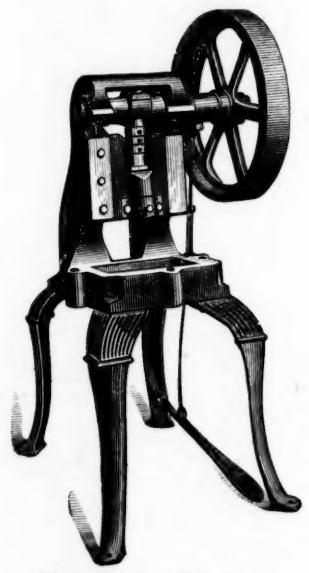
the flask. If an air furnace is used in the foundry three basins should be formed, one opposite each of the openings *A B C*, to catch the waste iron, but if there is no air furnace at hand, then a pig bed should be made, throwing the spare sand around the joint between the roll and flask so that there can be no run-out. The sand should be cleaned away from the outlets and runners made leading to the places formed for catching the waste iron. If the iron should be likely to run upon the face of the roll at the outlets, it should be smeared with oil at those points to prevent the melted metal from adhering to it. In commencing to pour the iron the ladle should be held very low, and then gradually raising the ladle until the metal will have a fall of about four feet. The ladle is supposed to be handled by a requisite number of men not shown. The man in charge of the process can easily ascertain if there are any places upon the surface of the fracture where the melted metal is not cutting, by means of the bent rod *D*, and the molten stream directed upon those places. Some small pieces of tin or zinc should be kept at hand, and by constantly throwing them into the mould, the iron in the holes that are burnt is thereby made hotter than it would be otherwise.

The iron should be poured until only about five hundred pounds remains in the ladle; the openings *A, B, C*, should then be stopped with a stopping stick and clay; then fill the neck neatly full of metal.

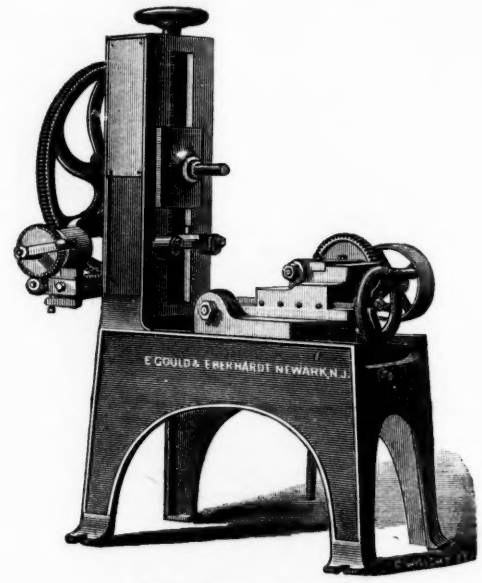
The protecting ring (which is a thin plate of metal, having a hole in the center, the same size as the neck, and is placed on top of the flask to prevent the falling stream of molten iron from cutting away the edge of the mould) should be lifted off at once by means of handles attached to it; then skim off all the dirt and slag from the surface of the metal, after which the wabbler mould 3, should then be quickly placed upon the flask 2, and the feeding head 4 upon the top of the flask 3. These flasks should be securely held by placing heavy weights upon the top, after which the mould should be quickly filled and fed with metal, until it solidifies. If the neck has been burned successfully, the old or original neck will be the first to break. In regard to the amount of iron necessary to complete the operation described, I may say, that it depends entirely upon the nature of the casting to be mended. For a roll weighing from 5,000 to 7,000 pounds, it will take about 1,800 pounds for burning on wabblers or neck, while on small rolls, about 1,200 pounds of metal will be required. The cost of the process is comparatively small, and saves the trouble and expense of turning up a new roll, besides effecting a great saving in time, which is a very essential point in rolling mills.



NEW LATHE.



NEW POWER PRESS.



NEW GEAR CUTTER.

A New Lathe, a Press and a Gear Cutter.

The first engraving on this page represents a new 16″-swing engine lathe, and is well adjusted for all kinds of work for which a lathe is intended. It swings 16″ over shears by 11″ over carriage; has steel spindle 2″ diameter, and front bearing $3\frac{3}{4}$″ long, of the best composition. The cones are $2\frac{1}{2}$″ face, and turned inside to balance, and bearing full length. The carriage is long, and slides are large, planed to an angle of 45°, rounded top, to which it is scraped to a fit. The carriage is held down by gibs, front and back. It is moved by an independent friction feed, through the wrought iron rack and simple gearing under the apron of the plainest construction. No worm is used. The reverse to the feed is also in the apron and always within reach of the workman, as well as the lever to open and shut the double nut, which is easily tripped in cutting threads, close to a shoulder or collar. The arrangement of the gearing at the head is such that the workman has a positive and changeable feed, also has the screw-cutting gearing at his immediate command, by simply loosening up one bolt without change of gearing. By this device, it is also impossible to have the turning and screw-cutting feeds both engaged at the same time. The tail stock is strong and substantial, and has a durable clamping, and slides on the two ᴧs, and is held to the bed by one bolt, and has a side traverse.

The second engraving represents an improved power press of simple, but durable construction, of which six different sizes are built. It is of the open-back form, thus admitting light, and being convenient in passing through work. The crank shaft is cast steel, and has large bearings, which are constructed so as to take up the wear direct.

It is believed by the builders that this feature is in no other press at this time. The wear is taken up by one screw directly under the cap. The steel clutch makes a positive stop for the crank on the top, and is composed of but two pieces. The adjustment of the slide is regulated in the usual way by a right and left hand screw, secured by jam nuts. Slide bearings are large and long, and scraped to a perfect bearing, and wrought iron work is case-hardened.

The third engraving represents an improved gear-cutting engine, of which five different sizes are built, cutting up to 18, 24, 36, 48 and 72 inches, respectively. The cutter slide moves on the main frame by a screw adjustment, which also carries the swivel joint used in cutting bevel gears, an improvement over having it cast on the main stanchion. In cutting bevel gears by the old method one is confined to a certain length of mandril, and gears with long hubs cannot be cut upon them.

The carriage works with a screw, and when desired, is provided with an automatic feed attachment. The worm-dividing wheel is claimed to be made with great accuracy. All the bearings are large and are scraped to a correct fitting. Index plates to regulate the change gears according to the gears to be cut, and a complement of change wheels are accompaniments to this machine, also counter-shaft and belt-tightener. The machine cuts spur, bevel and worm wheels; also internal gears and racks, when special attachments are provided.

All three of these machines have recently been brought out by E. Gould & Eberhardt, machine tool builders, Newark, N. J.

It is asserted that the prospects for the construction of the Baltimore, Pittsburgh and Chicago road to run from Pittsburgh to Chicago Junction are very encouraging.

Locomotives of 1880.

BY W. BARNET LE VAN.

The past year has been a fruitful one for the locomotive builders, and the demands upon them both for home consumption and for export have been greater than ever before.

The Baldwin Locomotive Works, of Philadelphia, have turned out 515 locomotives, and have orders on their books to run them at their full capacity for more than twelve months to come.

Notable amongst their productions is that of a single driver locomotive, No. "5,000," the five thousandth of their build which was originally intended for the Philadelphia and Reading Railroad Company, to run on the Bound Brook route, between Philadelphia and New York. It has made the 89.4 miles in 98 minutes, being at the rate of 54 miles an hour. It was finally sold to Mr. F. W. Eames, of the Eames Vacuum Brake Company, to be taken to England for experimental purposes. This is the first locomotive, with but a single pair of driving wheels, that has, of late years, been built in the United States.

The Baldwin Works are also employed in making, after the designs of E. A. L. Roberts, of Titusville, Pa., his patent-fitted piston and cylinder locomotive, which he claims to be able to run 80 miles per hour with perfect ease.

E. A. L. Roberts' improvement is in the construction of the cylinder and piston. The cylinder has the exhaust port formed of slots circumferentially around the center, and penetrates the interior of the cylinder. This slot is covered by annular covering or pipe so as to form a free exit of the exhaust steam, and is connected with the usual slide valve, as in cylinders, having steam ports on each end. The piston occupies half the length of the cylinder. When the steam is admitted on one end of the cylinder, the piston immediately covers the exhaust in its movement, and remains closed until the steam side of the piston reaches the exhaust port at the end of its travel when it uncovers it; which, in the ordinary cylinders, the exhaust commences to open when the piston has performed about two-thirds of its stroke, causing a loss of power on the balance of the stroke.

The inventor claims that his device immediately relieves the steam pressure at the end of the whole stroke, and passes it off through the annular slots, causing no back pressure, as in the ordinary constructed cylinders.

The inventor says, "By means of this improved construction, I am enabled to use the full elastic force of the steam during nineteen-twentieths of the stroke." He also claims that "as the piston uncovers the central slot at the end of each stroke, when it is on its dead center, the piston is at that moment theoretically at rest, allowing an appreciable time for the escape of the exhaust steam."

The inventor claims that by his improvements, his locomotives, with 16x20 inch cylinders and 54-inch diameter drivers, will be capable of running sixty miles an hour, with an ordinary passenger train on a good, straight track, with a saving of from 20 to 30 per cent. of fuel.

There has also been turned out from the Grant Locomotive Works, of Paterson, New Jersey, a locomotive, from the designs of Eugene Fontaine, who claims that it can be made to run 90 miles an hour, while the machinery is running no faster than that of an ordinary locomotive traveling at the rate of 60 miles. The crank axle is placed on top of the boiler instead of under, as usual; on the crank axle are two frictional wheels, $5\frac{1}{2}$ feet in diameter, which are in contact on the top of two other frictional wheels of 4 feet diameter, which are secured concentric on the outside of the driving wheels, $5\frac{1}{2}$ feet in diameter, which rest on the rail. The motion of the driving wheels thus communicated is increased in the ratio of their respective diameters, as 1 to 1.38; that is to say, that, providing there is no slip, the drivers proper will run one-third faster than the first driven wheel. It is not to be presumed that the inventor, with his experience in locomotives produced, has carefully studied the production of power, otherwise he would not have wasted the amount of money necessary to produce this abortion, as it is well known to engineers that power is speed (*velocity*) multiplied by pressure (*force*), and especially in locomotives it is an increased piston speed that is wanted for rapid transit, in connection with high steam pressure, so as to reduce the boiler capacity to a minimum.

This locomotive is running on the Pittsburg, Fort Wayne and Chicago Railroad.

At Concord, New Hampshire, it is said, a locomotive is building, with a flat boiler—2 feet by 7 by 12 feet, are the dimensions given—with the fire box in the middle. The engineer's position, like that of the pilot's on a steamboat, is to be at the front, and the fireman as now. The idea is to bring a large portion of the boiler over the fire, and increase its steaming capacity.

A noteworthy feature of the year's record has been the construction of a number of locomotives, both passenger and freight, with the improved fire box of Mr. I. E. Wootten, general manager of the Philadelphia and Reading Railroad, on which road they are in service, and have given very satisfactory results. This improvement consists in providing a very large grate area, by extending the fire box laterally above the driving wheels, without raising the waist of the boiler to any material extent. Insufficient grate area has been the defect of all locomotive boilers, and the veteran Ross Winans, years ago, took the lead in remedying it. Mr. Wootten's improvement would seem to have fully covered the ground in this direction, and is applicable to locomotives of all construction, and free from the objection and limitation inherent to former efforts.

The Consolidation Engine on this plan, with 20×24 inch cylinders, have fire boxes 96×114 inches, and among the express passenger engines, with fire boxes of about the same size, there is one having cylinders 21×21 inches. The schedule time of the latter locomotive on the fast express from 9th and Green streets, Philadelphia, to Bound Brook, 59.2 miles, including 3 stops, is 74 minutes, portions of the run being made at the rate of 70 miles an hour; and as an instance of these capabilities, it may be stated that a gentleman of this city left his house near Broad and Arch streets, Philadelphia, a short time ago, at 8 P. M., traveled to New York city behind one of them, transacted his business, and was at home and in bed at midnight.

The Pennsylvania Railroad Company have turned out from their Altoona shops a coupled locomotive, having cylinders 18×24 inches, 6 feet drivers, and a slab frame of the English type. It was designed to run the 89.2 miles between Philadelphia and Jersey City in 90 minutes, but from all accounts it has not proved a success. Some time in July last it was placed on the road and attached to a freight train, so as to be limbered up. It is now in the fast passenger service between Jersey City and Philadelphia. They still have difficulty in keeping cool its main boxes. They are of wrought iron, as also are the journals.

They now have in course of construction another fast express locomotive, with cylinders 18×24 inches, and 6½ feet drivers, which is expected to reduce the time between the two cities to 90 minutes.

No material advance has been made during the year towards the abatement of the smoke and cinder nuisance, which still continues to be the "eye sore" of the traveler. There is no valid reason why the particles of unconsumed coal clipped off by the force of the exhaust and carried through the tubes should not be returned to the fire box and usefully disposed of by being burned, instead of, as is now the case, being thrown out over the roads and into the car windows. Locomotives provided with apparatus for the purpose are now in service and are working with an economy of fuel in addition to entire exemption from throwing fire cinders or unburned coal, but the merits of the system, which is a reasonable and practical one, have not met the recognition they deserve. On the other hand, some railroad managers violate a well-established theory, and continue an unmechanical practice, the obvious defects of which should have long ago rendered it obsolete, namely: the use of an extended smoke box, which, under no circumstances, can do anything but uselessly transport a small quantity of hot cinders, while the rest are thrown out just as they were before. These blind guides have their imitators, who prefer to follow the lead of some one else than think for themselves, and the adoption of this more than useless device, as a so-called spark arrester, is to be recorded as a backward step, which has been taken during the year by several railroad companies.

In locomotives, we are greatly behind the English. Not that we have not the facilities, but that we are so completely enveloped in the dazzling cloud of American greatness, as to be indifferent to the progress of other nations. In England the greatest attention is paid to the arrangement of the boiler for the admission of air in comminuted jets over the coal, and by the use of firebrick bridges. In this country, but few combine these simple and common expedients. Coal burning is well known to be solely a chemical question, that of combining carbon and carburetted hydrogen with oxygen, in certain equivalents—not a mechanical consideration, as is generally treated. In England some locomotives run with as low as fourteen pounds of coal per mile. The average consumption of fuel in England is but little more than half as great as in this country. This indicates a wide field for improvement in our locomotive boilers.

True, the loads in England are twenty per cent. lighter, but the speed is twenty-five per cent. higher.

What is wanted in this country is a locomotive boiler, made with express reference to the admission and mixture of air with coal in combustion. Chemistry teaches us that this admission and mixture is all man can accomplish; nature effecting the rest.

Charles Wye Williams showed us that a brick arch and a few air holes sufficed for the required purpose of a "smoke burner." That is to say: Place a brick arch in the fire box, so placed as to deflect back the air from the tubes, so as to make the upper part of the fire box effective as a combustion chamber, and supply air through hollow stay bolts. This is done in the United States in some instances, but only to a comparatively small extent.

The English locomotive engines cut off much earlier and use much larger blast nozzles than we do, by which latter means a less back pressure is the result.

The application of the indicator to their locomotives is as common with them as its application to stationary engines is with us; in fact, in this country the application of the indicator to locomotives is the exception, not the rule, and if railway superintendents, in ordering locomotives, would insist of these being, when finished, accompanied with indicator diagrams of their cylinder steam action, at the speed they were to run at, better and more economical locomotives would be the result.

The economy of a locomotive is not, as yet, understood. With the majority of those now in practical operation, the power depends on the boiler pressure and the piston speed, as before stated. What is wanted for economical locomotives is a minimum weight with maximum power. To produce this, we must have high piston speed and a corresponding boiler pressure. For, as we reduce the weight of our locomotives, we reduce its adhesion. This latter must be provided for by a higher boiler pressure, To illustrate this, let us take the standard size locomotive for fast passenger service, using steam of 125 pounds to the square inch, with 5½-foot drivers, cylinders 17 x 24 inches, and making 300 revolutions per minute, and assuming the point of cut-off to be at half stroke, the tractive force will be:

$$T=\frac{17^2\times.7854\times24\times103}{66}=8,493$$

Now substitute a 15"x21" cylinder, with 6-feet drivers, and 200 pounds per square inch, and making 420 revolutions per minute, cutting off at half stroke, we have:

$$T=\frac{15^2\times.7854\times21\times167}{72}=8,607 \text{ pounds,}$$

and the horse power of the latter will be 50 per cent. more than the former.

$$P=\frac{226\times1\,200\times103}{33,000}=850$$

$$P=\frac{176\times1,500\times167}{33,000}=1,341$$

The only limit to the speed of the piston is that at which the piston packing begins to "cut" the bore of the cylinder, and with the very hard iron of which cylinders are now made, and with the light steel packing rings now in use, it is certain that a mean piston speed of 2,000 feet per minute may be maintained, not only with safety, but with great advantage.

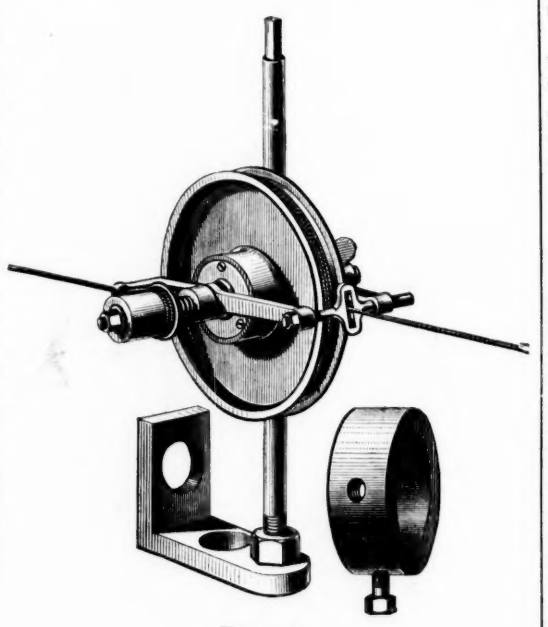
Small-cylinder locomotives would have less condensation, and hence expansion could be advantageously carried to a greater extent than with larger cylinders, working with the same quantity of steam. The loss by condensation (and this is the great drawback of expansive working) would be relatively still less also, because the short interval for cooling at the increased speed of the smaller piston. With fast-running engines a given quantity of steam would be discharged in smaller quantities, but at more frequent intervals up the chimney, the blast thus approaching more nearly to a continuous flow of steam.

In fact, mere frequent exhausts of steam into the chimney enables a smaller boiler to evaporate more water from a given heating surface in an hour than a larger boiler with less number of exhausts in the same time.

Our difficulty is not in knowing what is the proper thing, but it is in not putting into practice what we do know. Watt knew the whole thing of expansion, and almost how much power could be got out of a given weight of steam expanded to a given extent, and protected from condensation during expansion

Oliver Evans and Woolf, adapted the principle to high-pressure steam, and to-day our most approved steam marine and pumping engines are on the Woolf plan. Why have not our locomotive superintendants followed in their foot steps? It is not for the want of education or intelligence nor is it too late now to commence.

Let them go to any of our leading locomotive builders and say they want a locomotive that will make sixty miles an hour with a consumption of 25 pounds of coal per mile run, pulling a train of not less than 125 tons, and stipulate that as a guarantee, the builder must produce indicator diagrams at this rate of speed, cutting off at not over ⅜th of the stroke with a moderate amount of back pressure, and an initial steam pressure in the cylinder within five pounds of the boiler pressure. Let them state, in case the above is complied with, that $1,000 will be paid above that of the market rate. They will not have to call upon more than one or two builders before their offer will be accepted. The result will be that at the end of the first year's run orders will all be given under these conditions.



REDUCTOR.

In regard to the indicator, the diagrams taken on locomotives running 60 miles an hour show an excessive wire-drawing due to the working of the link which is defective, and now is the time, in these days of high speeds, for the production of a better valve gear. The evil is so great that some additional complication of this structure would be justifiable. In our fast-running passenger engines, with 125 pounds boiler pressure, the diagram will show perhaps 90 to 100 pounds at the beginning of the stroke. This falls when the piston has moved above 4 inches of its stroke to about 65 pounds, and the actual point of cutting off is altogether lost in the rapid fall of the expansion line towards the exhaust end of the card. The average pressure throughout the stroke, does not exceed 40 pounds and the real gain from expansion will be about the same, if steam of 75 pounds had been admitted for about one-half the stroke and then cut off. So it will be seen that in our present construction of slide valve, one-half the boiler power is expended in forcing it through the narrow openings to reach the pistons, and, according to the mechanical theory of heat, a corresponding part of the steam must be condensed and lost. This great defect is due to the scant opening which the link motion gives in the notches after we leave the center notch.

In the locomotive "5,000" the Allen valve was used, but as the indicator was not applied we have no knowledge of its working. The Allen stationary high speed engine also uses a valve with double openings, and, judging from the diagrams produced by this engine, no doubt would answer locomotive purposes. Unless something of this character is adopted for the more expeditious entrance into the cylinder is obtained for the steam, it is a question if not some radical change shall have to be made in locomotive valve gear. The link is undoubtedly the simplest gear known for locomotives; but its mere simplicity is not sufficient to justify such a considerable waste of boiler power, especially for the high speeds now demanded for our flying trains. What is wanted is an automatic cut-off arrangement similar to the modern high-speeded cut-off engines now in general use.

When the indicator is more generally employed—that is to say, when locomotives are accepted on diagrams produced by them in making the speed and pulling the load expected of them, this evil, as above stated, will be recognized, and its correction will eventually follow, as has been the case in our portable and stationary engines, by the means of the indicator.

As steel rails and tyres have added so much to our railway improvement, we must go farther, and in our locomotives adopt steel axles and boilers. So, too, must all other details be observed for an economical maintenance of present and increased speeds.

New Reductor.

The objections to a lever, as a medium for transmitting motion from the piston rod, or cross head of a steam engine, to the paper drum of an indicator, are evident to all engineers who have had any experience in testing steam engines. It is generally very difficult to obtain the correct ratio of motion between the stroke of the engine and the paper drum, particularly upon marine engines having a stroke of twelve feet or more. The object of the reductor, represented by the accompanying engraving, is to furnish a simple and effective device, by means of which the desired result may be attained at once. The construction of the reductor is very simple, consisting of a shaft to which is attached a drum having a ribbon spring inside, wound around the shaft. A cord leading from the cross head, or other convenient part of the engine, is attached to and winds upon the outside of the drum. A smaller drum or pulley is placed upon the shaft for carrying the cord to transmit motion to the paper drum. There are eight small pulleys of different diameters accompanying the large reductors, so that a convenient ratio of motion between the stroke of the piston and the throw of the paper drum may be at once established. A thread is cut upon one end of the shaft, which is fitted to one of the journals, and as the drum rotates the journal is moved endwise, carrying the guides for the cord along with it. The object of this movement is to prevent the cord from climbing or becoming entangled. This reductor is provided with a stud or support, also a bracket, guide pulleys, and other fixtures, for attaching it either directly to the engine, or to the floor of the engine room.

The Lake Erie and St. Louis Railroad Company has been organized to build a road from Portland, Jay county, Ind., west to the Illinois line in Vermillion county. This is part of the Lake Erie and Western's proposed extension to St. Louis.

It is proposed to build a railroad from Lowville, N. Y., on the Utica and Black River road, west to Harrisville, about eight miles. A survey is now being made.

Brazing, or Hard Soldering.

BY THOMAS F. HAGERTY, M. E.

The object of this article is not to give instructions to coppersmiths and other workers in sheet metal, whose business is to unite metals by means of "*hard solder.*" It is here presented for the benefit of metal workers, and others who have had no experience in brazing, yet who are sometimes, in case of emergency required to undertake the experiment *for the first time.*

The first thing to be considered is, what kinds of metals unite best? Second; what kinds of solder are best adapted to meet all the requirements of the job? Third; what kind of flux, and in what quantity should it be used with the solder, and how should it be applied to the parts to be united?

It is also of importance to know the kinds of metals it is *practically impossible to braze* in order to save time and patience in a fruitless effort.

Yellow brasses containing from two to four parts of copper to one part of zinc, can be united to malleable iron, steel, copper, or any of the alloys of copper which do not contain over ten per cent. of tin and lead, and will readily unite with each other.

The solder best adapted for yellow brasses, or copper, is spelter or "broom solder," composed of equal parts of copper and zinc. The addition to this solder of a small quantity of either tin or lead is recommended by English and American authorities, without giving any reason why. I have found that tin makes it close grained and brittle, while lead makes it porous and rotten. These mixtures are therefore injurious. To unite iron to iron, or copper to copper, where the object has to be bent or hammered afterwards, yellow brass clippings will be found the toughest, yet in most cases spelter solder holds strong enough.

Valuable steel punches and dies can be brazed and made as serviceable as ever, if properly handled. To make a successful job, clean the broken joints, and before bringing them together, sprinkle them with pulverized borax; bind the parts together with iron wire, and a small quantity of wet clay, forming ridges on both sides, so as to confine the heat, the solder and the borax to the joint. Heat up gradually, in a charcoal fire, and when the steel begins to get red hot put on more borax, and heat up rapidly until the solder begins to melt, which will be readily seen by the white smoke of the zinc in the solder, if spelter is used, which, now begins to burn up.

With an iron rod in the right hand remove the clay and rub the point of the rod over the joint to clean off the borax and distribute the solder. Should the steel be heated up to the required tempering heat, the article should be plunged immediately into the water or other tempering solution, as if hardening, and can then be drawn to the required temper in the usual manner. With steel, sterling silver should be used as a solder, or spelter solder, if it can be had conveniently, as either of them melt and flow before the steel becomes overheated or burnt. They are also tough enough to stand ordinary strains.

In piecing out iron boiler tubes with copper or iron end pieces, the following simple method will be found of value. After having cleaned and fitted the copper or iron piece into the end of the tube, and driven it in securely as far as required, wind one strand or ring of copper wire (about 18 gauge) around the piece close to the joint, say within $\frac{1}{8}''$ of the tube end. When the spelter solder and borax are applied to the joint, the wire prevents the solder, when melted, from spreading, and not only confines the solder to the joint, where it will do the most good, but makes it unite with it, thus making a neat and solid joint.

This differs from the usual method employed only in the confining of the solder to the joint, by using a piece of copper, brass or iron wire as described.

For small odd jobs, of German silver, yellow brass, steel or iron, when it is not convenient to procure any of the commercial spelter or silver solder, silver coin hammered out thin, and cut into narrow strips, will be found serviceable. Care should be taken in every case to heat up gradually at first, so as to give the borax time to flux. The solder, which receives its heat through the metal article should have time to heat up, as a quick heat strikes the under surface of the article being brazed, and melts the borax first, which flows through, leaving the solder yet solid; hence when the solder melts, the joint is left dirty and does not unite, but flows through after the borax into the fire; should additional solder and borax be applied while the article is yet red, the additional heat required to melt the fresh solder will also melt the article being brazed.

This has been the cause of every vexatious failure; therefore, heat gradually, and use but a small quantity of solder and borax, as too much, when it melts, spreads and leaves the joint bare.

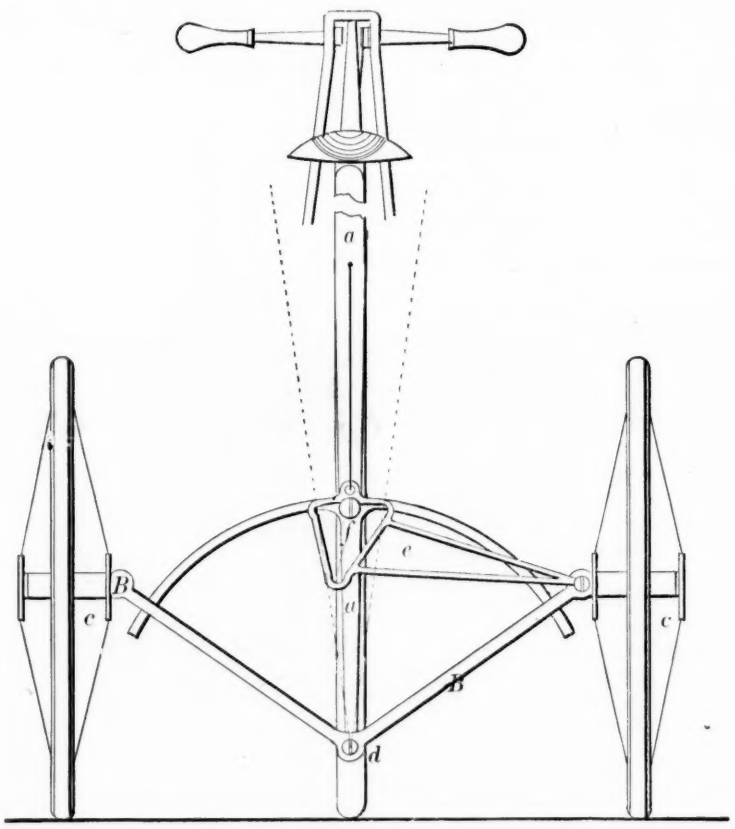
Cast iron cannot be successfully united to cast iron or to other metals by means of solder, therefore time can be saved by avoiding it. This is also the case with alloys of copper and tin, which are without reason classed with yellow brass, and supposed to be easily brazed by persons not experienced. In attempting to braze a copper, iron, or yellow brass tube to a flange composed of an alloy of copper and tin, the following plan should be observed. The joint, after being prepared and a sufficient quantity of borax and solder placed around it, is inserted in the center of a bright charcoal fire and the blast applied, before the flange has reached a red heat. The tin in its alloy exudes through to the under surface. By this time the borax flux has followed the tin, carrying it through into the fire. The solder next begins to melt, but it has parted company with its only carrying and cleansing agent, the borax, and as the joint is left in an oxidized or dirty state, the solder will not flow. It therefore runs through and is burned up. If the operator piles on more borax and solder (as he invariably does), the flange will now be so overheated, that it will drop into pieces before the second dose melts. This would not be the case if yellow brass flanges were used. Therefore, use yellow brass for the fixed flange, and any kind of brass (unknown stuff) will answer for the loose flange.

"Knight's Mechanical Dictionary" tells us that "Brazing is soldering the surfaces of copper, brass, etc., with an alloy composed of *brass* and zinc, sometimes with the addition of a little tin or silver." Now, why should this mechanical compiler say "brass and zinc," without first stating how much zinc there was in the brass? Why not say at once, an alloy composed of *copper* and zinc, copper being the prime article. If either brass or zinc, or both, were added to it, it would still be an alloy composed of copper and zinc. But the most amusing part of all is the information he volunteers, that "This [process] may be assisted by the use of *a soldering iron.*" This expression is enough to make a soldering iron laugh. He might as well have said that it could be assisted by rubbing a piece of butter upon it.

The Tricycle.

BY F. G. WOODWARD.

Were the bicycle capable of standing upright like the tricycle, so that the rider could mount and dismount it at his leisure without fear of falling, it might justly be regarded as the *ne plus ultra* in the line of this class of vehicle, and its utility and popularity would be greatly extended. But like the two-legged stool, the bicycle is decidedly averse to standing without extraneous help, hence it requires great practice on the part of the operator, and the agility and address of a tight-rope dancer to mount a modern bicycle and get decently started.



TRICYCLE—FIG. 2.—REAR VIEW.—SCALE $1\frac{1}{2}''=1$ FOOT.

Hitherto the tricycle has not been received with much favor by professional "wheelmen," for the reason that it has lacked that flexibility in traversing curves which the bicycle possesses. The accompanying sketch shows a modification which is designed to render the curving capabilities of the "three-wheeler" equal to those of the "two-wheeler." This has been accomplished by jointing the rear end of the perch or body *A*, of the bicycle, to the center of the axle *B*, of the two rear wheels *C*; the axle being bent downwards, as shown, so as to bring the joint *d*, as near the ground as possible. Fig. 2, being a rear view enlarged, a latch *e*, is jointed to the axle near the hub of one of the wheels, as shown, the latch being operated by a cord attached to the guiding handles. When the rider wishes to mount or dismount, he gives the handles a partial twist, which brings the latch upon the stud *f*, fixed in the perch. The perch is thus held rigidly upright. When fairly started, the rider has simply to release the latch and let it drop to its normal position, as shown, thus giving the machine equal freedom with the bicycle.

The year 1881 opens with brilliant prospects for both new and old railroads.

Safety in Factory Buildings.

In a supplemental report on the objects and methods of Factory Mutual Insurance Companies, Mr. Edward Atkinson presented a paper on Safety in the Construction of Factory Buildings from which we extract as follows:

It may be, perhaps, deemed presumptuous to frame an indictment against customary methods of building that are almost universal, but it must be remembered that it is not many years since the profession of architect had any existence in this country: and while in those few years great progress may have been made in the fine art of architecture, it is also unfortunately true that, as the fine art made progress, the useful art of building has been neglected, in consequence of which neglect the heaviest single tax now imposed upon this nation is the FIRE TAX.

The owners of property adopt unsafe methods of building, without much consideration, because they are apparently cheapest, and rely upon policies of insurance in companies that have been licensed by the State, and are assumed to be solvent, because they meet an arbitrary rule of little value as a test either of management or solvency. Architects are almost precluded even from suggesting better methods of construction, and the art of building is becoming a lost art.

CONSTRUCTION TO BE AVOIDED.

Roofs of any shape constructed of common plank rafters 18 to 24 inches on centers, covered with one-inch boards, iron or any other material, and sheathed or plastered upon the underside of the rafters.

Boxed cornices of every kind.

Floor frames of plank 18 inches to 24 inches on centers, set edgewise in the usual way. Such floors are undesirable, even if not sheathed or plastered on the underside, and if sheathed or plastered are more unsafe, unless plastered on wire.

Furrings on side walls on which either sheathing or plastering is placed. Wooden dados furred off. That is, avoid any concealed space behind wood-work.

Open elevators.

Iron doors on openings in party walls.

Iron shutters.

In general, our motive is to avoid the common construction now prevailing in stone churches, brick schoolhouses, stone and iron warehouses, hotels, hospitals and almshouses.

CONSTRUCTION TO BE ADOPTED.

Having thus described the methods of construction and the causes of loss that we endeavor to avoid, we may now state the methods that we advise.

In order that a building shall be safely constructed, and on the whole not more expensively than if built in the customary bad method, the points to be kept in view are few and simple:

1st. That the disposition of the timbers of the frame of both floors and roof shall be made in such solid manner as to burn slowly; that such timbers shall all be open, smooth, and that the corners shall be chamfered off.

2d. That the floors and roof shall be of thick plank, with mortar or sheathing-felt between the plank and boards of the floors.

3d. That there shall be no concealed space in the building under a floor, behind a furring, or in a partition where a fire can lurk out of the reach of water, or where a rat or a mouse can build a nest of any material; many fires being caused by rats building nests of oily rags, or other substances liable to spontaneous combustion.

4th. That all elevators, stairways, or other openings from floor to floor, shall be adequately cut off by properly constructed hatches, doors and other appliances, mostly automatic in their working.

5th. That openings in party walls, exposed windows, etc., shall be protected by adequate wooden doors or shutters covered with tin, automatic appliances preferred.

6th. That all rooms in which special dangers exist shall be plastered on wire lathing close to the surface of the ceiling and following the line of the timbers; and that all iron posts in exposed places, or other iron or stone posts on which the safety of the building greatly depends, shall be carefully protected from fire either with wood and tin, or wire lath and plastering.

The Cleveland, Columbus, Cincinnati and Indiapolis railroad company has decided to increase its equipment by 10 heavy Mogul engines and 1,000 freight cars, and contracts will be let shortly.

The air line railroad from Meridian, Miss., to New Orleans is among the latest Southern enterprises. The survey of the line will begin at once.

One of the correspondents of the *Jeweler's Journal* thus calls attention to a practice in the trade which seems to be an injustice to retail dealers:

As the *Journal* is strictly a trade organ, published for the benefit and in the interest of the trade, I believe it the proper place to enter complaints against jobbers and manufacturers, who work against our interests by flooding the country with their catalogues and discounts, and yet claim they only send them to actual dealers, when cards are sent with application for catalogue.

To-day I got hold of a couple of illustrated catalogues, price-lists and discounts, from the Chicago branch of a Clock Co., sent to dry-goods and hardware men here, who do not deal in anything of the kind.

Again, a day or two since, I saw a catalogue, price-list and discount sheet from a well-known jewelry house, which was sent to parties who are in the dry-goods business, and do not deal in silverware, jewelry or clocks. I also saw a letter to the same party, where the dealer sold them a single article from their catalogue, allowing them 33⅓ per cent. discount.

The Korting Steam Blast Nozzle.

The steam blast nozzle represented by the accompanying engraving differs very materially from any other apparatus designed to produce similar results, it being simply a series of steam nozzles of gradually increased area, and placed one above the other. By allowing a small jet of steam to enter a nozzle in the focus, at the lower or smaller end, the air is driven out, forming a partial vacuum. The air is carried along through contact with the inducing current, thus imparting a high velocity to the air in front of the nozzle. When properly applied to the base of a chimney, it is claimed that the draught created is equal to that of a chimney fifty per cent. larger. By an application of this nozzle, the necessity of building an addition upon the top of the chimney to secure a better draught has been avoided.

Probably the most valuable qualities of this nozzle become evident where the growth of business compels an increase of the present boiler power, or replacing boilers by new ones. In making such enlargements it becomes necessary to have a larger chimney capacity, which is a serious obstacle, especially in large cities. The flues are generally of a crooked or contracted form, and to secure a good draught is almost impossible. These blast nozzles are one of the steam-user's specialties, sold by A. Aller, 109 Liberty street, New York.

The Western Weighing Association's figures show the average weight of machinery per car load to be 23,750 pounds.

A railroad from the West Coast, near the Senegal river, to the Soudan regions of Central Africa, under the auspices of the French government, seems likely to be realized within the next few years. The proposed road would run through a hot, but rich and fertile country, and will probably produce important general results.

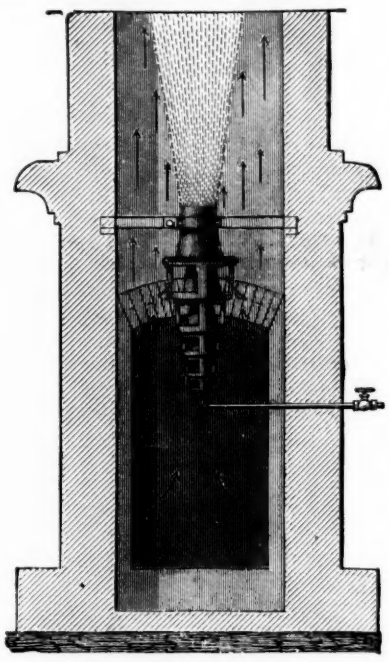
The Malvern, Princeton and Southern, a new Arkansas railroad company, proposes to construct a road from Malvern, Hot Spring county, thence southeasterly via Princeton, Dallas county, to a point on the Little Rock, Mississippi and Texas Railroad. Distance 65 miles. Capital stock, $4,000,000.

The Georgia Legislature has passed bills to charter the Atlanta and Alabama road, to run from Atlanta to some point on the Alabama line and the Rome and Chattanooga road, to connect the two cities named and Buena Vista.

The National Steam Boiler Company, Boston, Mass., has been incorporated, with E. H. Ashcroft, President and Treasurer. Capital, $12,000, in shares of $100 each. For the manufacture and sale and operation of steam boilers and others relating thereto and connected therewith.

It is reported that negotiations are in progress for the sale of the Adirondack Road to the Saratoga Lake Company, and for its completion through the wilderness to Ogdensburg, N. Y.

The Chicago, Rock Island and Pacific Railroad Company, are reported to be arranging to build an extension of the road from Leavenworth, Kan., to Topeka.



STEAM BLAST NOZZLE.

LETTERS FROM PRACTICAL MEN.

Reasons Why Pattern Makers are Unjustly Blamed.

Editor American Machinist:

After reading the hints to machinists and pattern makers, by a foundryman in your issue of the 25th ult., I thought I would most meekly submit a few facts about pattern making "to his unbiased consideration." First, he says that pattern makers never think of consulting a foundryman as to the best way of making a pattern. For my part, I don't think a pattern maker has any need of consulting a foundryman at all on the subject, *that is if he is a pattern maker.* The great trouble is, and I suppose it always will be, that nine-tenths of the patterns made are not made by pattern makers, at all; nevertheless the poor pattern makers have to take the blame for blunders they are not guilty of. If a man is really a pattern maker, and understands his business, he understands moulding as well as he does drawing or any other branch of the business. I will not encroach upon much of your valuable space by enumerating them all, but I believe there are more trades combined in pattern making than in any other trade under the sun.

In regard to the way the gentleman closes his letter, I should say he knows very little about pattern makers. If it were otherwise he would never express himself the way he did, when he said that pattern makers make their core prints straight on the bottom of a hub. I never knew a pattern maker to be guilty of such a thing, they always taper them on the bottom, but not so much upon the top of the hub, because there is no need of it. The reason the point on the top is tapered so much more than at the bottom is to prevent crushing the mould in closing the cope, or, more plainly speaking, the top half of the moulding flask. In conclusion I will say that all this grumbling of foundrymen might be stopped if manufacturers and others would engage pattern makers to make their patterns instead of carpenters, cabinet makers and others, that know nothing about the business.

A PATTERN MAKER.

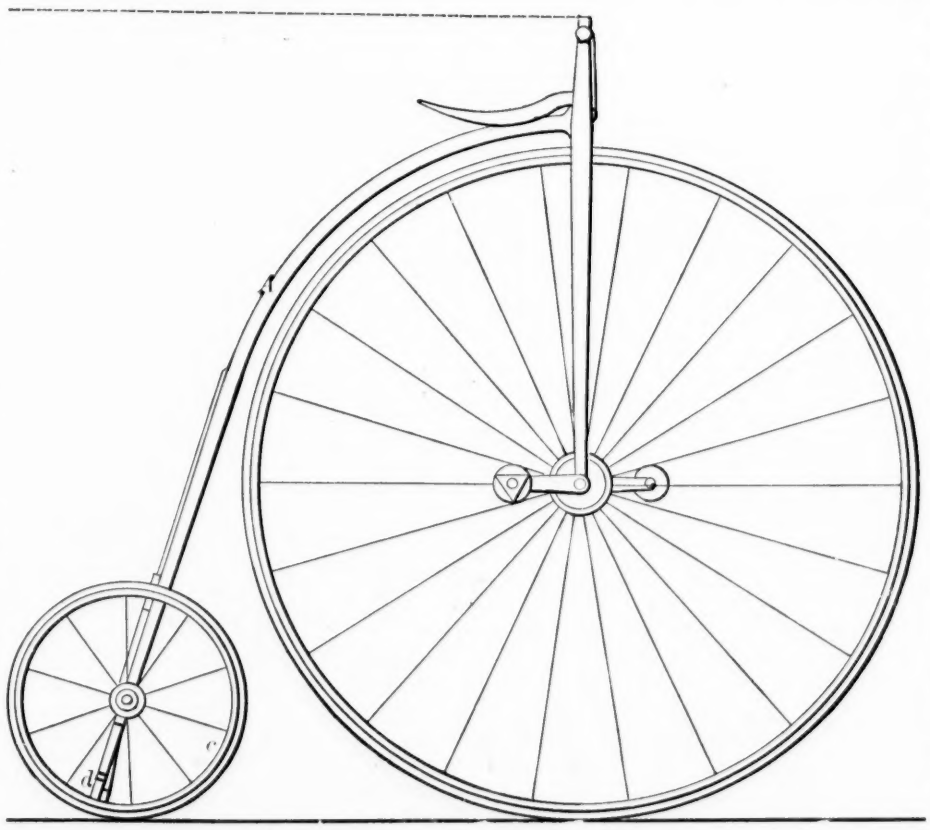
YONKERS, N. Y.

Observations in a Lincoln, Neb., Iron Foundry.

Editor American Machinist:

Two years ago while in Lincoln, Nebraska, I made a visit to the principal machine shop and foundry of the place. On entering the machine shop I saw no one in the room, and passed through into the foundry where all hands (about a dozen) had been called to help in running off the heat. In this establishment the motive power was situated in the foundry. I first looked at the steam gauge, but by reason of a cloud of steam which was issuing from suspicious places in the top of the boiler, I could not read the figures upon it. I asked the engineer how much steam he carried. His answer was something like this: "Oh, somewhere about fifty or sixty pounds. The gauge is out of order and don't work." I then looked at the engine—about a ten horse power. A man with but little knowledge of the steam engine would suppose that the machine exhausted through the stuffing-box. I did not see the cross head, by reason of the dense fog which prevailed. I noticed, however, that the governor belt was off, probably to give the engine more speed for the fan. The foreman and two or three others were piling bricks against the tweers to keep them from blowing out, while another was closing the joints with rags. One of the men ran the tapping bar into the cupola, and out came some slow, sluggish iron too cold to pour. The hole was closed up and all hands waited for hot iron. At this moment a wooden plug blew out of a pipe connecting the hot water pump with the boiler, and following it went a stream of hot water, as though from the nozzle of a fire engine, across the foundry floor, the men gracefully moving out of its way. The engine now finding relief from the hard work on the pump, started off at double quick, causing the fan to howl terribly, and severely shaking the shafting and hangers. Of course, the engineer ran to shut down the engine, but before he could close the throttle two belts had parted and laid themselves down to rest. About this time I remembered what the engineer had told me, and not having seen a safety valve on the boiler, or any way to close the draught, I thought I would not wait to see the heat through, and went away.

J. E. MCCONNELL.



TRICYCLE.—FIG. 1.—SCALE ¾″=1 FOOT.

The Belting Question.

Editor American Machinist:

In your issue of December 25, your correspondent, Mr. Rose, expresses himself as astonished that in the discussion of the belting question no one has attempted to explain the fact that "the driving power" (of a belt) "increases with the smoothness and truth of the pulley surface," etc. Now, I have no theories on this question; what little I ever had, being driven out of me years ago, but I am one of those benighted individuals who believe this smooth-surface business has been considerably overdone. In other words, as I understand the term, I don't believe an absolute smooth surface to be the best condition for the face of a pulley to transmit the most power with a given belt. I have made cast-iron pulleys reasonably rough, have turned them decently smooth, scraped and polished them to a fine surface, and have cross-filed their faces, and long ago came to the conclusion that the roughly turned and the *very* smooth pulleys were about equal, so far as slipping of the belts was concerned; that the smoothly-turned one was better, and that the pulley not too smoothly cross-filed was considerably better than either.

Some years since a cone pulley on an upright drilling machine became accidentally broken. As time was important, I had a wooden one made to take the place of the cast iron one. Now, the wooden one was hurriedly made, and was *not* famous for being smooth; yet it was evident to the least observing man in the shop that the wooden pulley was far superior to the iron one for transmitting power. The cast-iron pulley, by years of slipping of the belt, had become polished to a degree that would have delighted the eye of a critic on high finish. Query: Did it transmit less power than the wooden one, because it was smoother, or did the wooden one transmit the most power because it was rougher; or was there some other reason for the difference? Did anyone ever hear of a belt slipping on a pulley until it (the pulley) became highly polished, and then, by virtue of the increased surface, taking right hold and doing the work? I ask this question because I should like to know if my experience—which is that such a pulley becomes less and less fit for duty, either with that or another belt, just in proportion as it becomes smoothed by the belt—is contrary to the experience of others.

Some weeks since one of the order of geniuses came around, with a grip sack in his hand, inquiring for troublesome belts. No man ever made that inquiry in any establishment in this country without having the desire of his heart gratified, and his eyes were soon gladdened by the sight of four offending members, some of which had been the fruitful cause of considerable profanity. Our grip-sack friend then got down to business by proposing, for a reasonable compensation, to cure this malady. Satisfaction or no pay. He put it stronger than

that, viz, that, in addition to the withholding of all emoluments, he would suffer himself to be kicked off the premises in the event of a failure. It was a night job, and the next morning those pulleys presented a surface of paper, reasonably rough, and in some instances made up of laps and leaders in such a manner as to suggest the loss of a large percentage of belt surface. He covered six pulleys, one of which had never been turned, while the others had been turned, and four of them had become highly polished by the belt, and every one of those belts took right hold, as if they had always been above the suspicion of slipping. They did not hold better because the surfaces were smoother. They were not smoother. They did not hold better because the belt had more surface to hold to. It did not have so much. Query: Did they hold from the interlocking of the rough surfaces—just as two rough metallic surfaces interlock, causing friction?

I mentioned the cross-filing of the face of pulleys. Several years ago, when I enjoyed the reputation of a young tramp machinist, I struck a job in a shop not a hundred miles from New Haven, and was immediately elevated to the dignity of trying to build a bit of experimental machinery for a genius who knew considerably less of machine work than I knew. (I had been at the business just four years, and, of course, had not learned that I did not know anything certain). I have often thought since that what he and I *didn't* know, could have improved the character of that machine materially. However that may be, what I thought I knew, was, how to make a pulley, and what my friend, the genius, thought he knew, was, that a small, and from the surroundings, necessarily narrow one would be crowded a little too closely. I turned, and scraped, and polished that pulley for about the best surface I knew how to get, but when we set that machine running, the belt failed. Sometimes it would drive, but oftener and generally it would not.

After coaxing it about five minutes, my patron deliberately went to work and ruined that pulley; that is, he removed the belt and, taking a bastard file, scratched it (you couldn't call it filing, he wasn't capable of it) across its face, until it looked, as it was, a thing of ridges and hollows. I knew he had ruined it, because the old foreman, with whom I served an apprenticeship, had taken great pains to explain the theory of driving with a belt—perfectly smooth surfaces, atmospheric pressure, etc. That belt, without any amendment, went back on that ruined pulley, took right hold, and didn't let go, either. Now, I knew then, and do yet, that about one-half of the surface of the pulley had been destroyed; that air had been let in between the belt and that surface, and that it hadn't any sort of right to go along destroying the best theory in the world, but it did it all the same. I saw another individual, who didn't know anything about belts, cure one of slipping, by drilling away one-quarter of the surface with a $\frac{3}{16}''$ drill. As I intimated at the beginning, I haven't any theory left to speak of about belts. I know that every one knows of belts which are successfully transmitting power under such conditions as to call for the utter failure of any well-regulated belt. I know that every one knows that other belts are failing to do what an equally well-regulated belt ought to do every time; but one thing I don't know, which is: if I am using 1,000 feet of 1″ belt per minute, and that belt drives in whole or in part, by virtue of atmospheric pressure holding the belt to the pulley, how much it costs to pull that same 1,000 feet away from the pulley against the same atmospheric pressure.

Referring to Mr. Rose's queries in their order:

First.—Undoubtedly, the area of contact is increased by increasing the smoothness of pulley surface.

Second.—I believe the driving power of the belt is increased by increasing the smoothness, or, rather, by making the roughness of the pulley surface less pronounced and *more regular* up to an extent depending on, and varying with, the circumstances, after which any further effort in that direction results in an obvious loss of that power.

Third.—I believe the driving power of a belt is due to the interlocking of the belt and pulley surfaces, and any increase in the bearing surface, beyond some extent limited by the character of the surfaces and the tension of the belt may be more than neutralized: first, by a less pressure between the surfaces than necessary to properly interlock the surfaces, and second, by not presenting sufficient asperity of the pulley to properly interlock, or to properly hold when interlocked, with the belt.

Fourth.—The grain side of a belt will generally drive more than the flesh side, because, for obvious reasons, it presents a better surface for interlocking with the projections on the pulley, and more strength to hold when so interlocked. (I should be sorry, however, to be understood as advocating the use of that side of the belt next the pulley under ordinary circumstances.)

Fifth and Sixth.—The terms are not yet coined in which to express this degree of smoothness, and I venture to doubt if one in fifty takes the pains to consult the coefficients of friction for leather belting, in designing belt gearing, or, if he does, places much reliance on them.

The spherical pulley proposition seems in part to be another way of making a statement which no one would think of denying; that is, that the spherical surface and the plane surface do not differ materially so far as friction against them is concerned; but the assumption that the same gross pressure exists between his leather and sphere, after changing his leather into a belt, and his sphere into a pulley, and his arc of contact from 10″ to 5″, seems wrong, because, with a given tension, the angle of the belt, as it approaches and leaves the pulley, fully determines the gross pressure. Mr. R.'s diagram points out very clearly what must be done to make the belt drive the same with an arc of contact of 5″ as with one of 10″, viz.: increase the width and tension until the same gross pressure against the pulley exists. In doing this, the area of contact is increased, but since this increase alone is not sufficient, and since the expression "increase the arc of contact" is complete in itself, as increasing this arc implies and includes an increased gross pressure, it would seem to be the correct expression.

F. F. HEMENWAY.

Troy, N.Y.

A Dip into Algebra.

Editor American Machinist:

In your issue of November 13, on page 9, you state the rule for calculating the centrifugal force of revolving bodies; and add that the center of motion, in the rule given, means "the circle of motion of the center of gyration of the body." Permit me to opine that the word gravitation, instead of gyration, should have been used. The following figuring will show the reason:

Suppose an object, of any shape, to be revolving on the axis O. The Figure shows the position of this revolving body at a certain moment. Call its weight W, its mass M, the co-ordinates of the center of gravity X_{gr} and Y_{gr}, and the co-ordinates of the center of gyration X_{gy} and Y_{gy}. Let its number of revolutions per minute be n, its angular velocity per second w, and the acceleratric g (=32.2 feet). Let us consider the point A, the mass of which is m, and whose co-ordinates are x and y, and its centrifugal force c, and its weight A.

According to your rule the centrifugal force of A is

$$c=A.\left(\frac{2r\pi.n}{60}\right)^2\div g.r=\frac{A}{g.r}\left(\frac{2r\pi n}{60}\right)^2$$

or by introducing $m=\frac{A}{g}$ and $w=\frac{2\pi n}{60}$

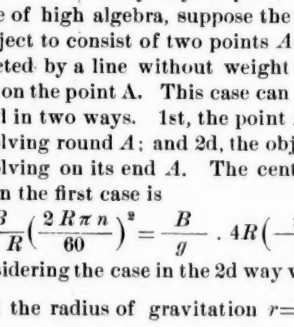
$$c=\frac{m}{r}.(w.r)^2=mrw^2$$

(I prefer to use this formula for centrifugal force because it is much shorter than others.)

If we now resolve c into its components c_x and c_y then $c_x=(mw^2x)$, and $c_y=(mw^2y)$ (see similar triangles). The total centrifugal force is equal to the sum of the centrifugal forces of all the material of the revolving body. Hence

I. $\begin{cases} C_x=\Sigma c_x=w^2\Sigma mx: \text{ and} \\ C_y=\Sigma c_y=w^2\Sigma my. \end{cases}$

The co-ordinates of the center of gravity of the revolving body are



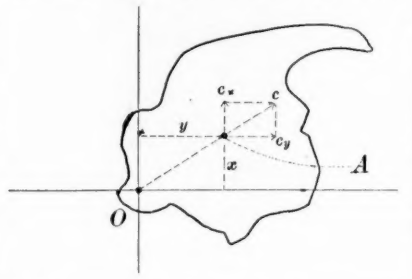
II. $Xgr=\frac{\Sigma mx}{\Sigma m}=\frac{\Sigma mx}{M}$, and $Ygr=\frac{\Sigma my}{M}$

while those of the center of gyration are

III. $Xgy=\frac{\Sigma mx^2}{M}$, and $Ygy=\frac{\Sigma my^2}{M}$.

From II we may find $\Sigma mx=Xgr\ M$, and $\Sigma my=Ygr\ M$; and it follows that

$C_x=Xgr\ .\ w^2\ .\ M$; and $C_y=Ygrw^2M$;



and the resultant of C_x and C_y is the centrifugal force C, which (by considering similar triangles) is found to be

$$C=Rgr\ .\ w^2.\ M,$$

where R is the distance of the center of gravity from the center of rotation.

To show the fallacy of your point without the use of high algebra, suppose the revolving object to consist of two points A and B, connected by a line without weight and rotating on the point A. This case can be considered in two ways. 1st, the point B alone is revolving round A; and 2d, the object AB is revolving on its end A. The centrifugal force in the first case is

$$c=\frac{B}{g\ .\ R}\left(\frac{2R\pi n}{60}\right)^2=\frac{B}{g}\ .\ 4R\left(\frac{\pi n}{60}\right)^2$$

Considering the case in the 2d way we have to find the radius of gravitation $r=\frac{R}{2}$ (supposing $A=B$) or the radius of gyration $r=\sqrt{\frac{R^2}{2}}=R.0{,}7071$ and the centrifugal force, taking the circle of the center of gyration would be

$$c=\frac{A+B}{g\ .\ 0{,}7071R}\left(\frac{2.0{,}7071R\ .\ \pi\ .\ n}{60}\right)^2$$

$$=\frac{2B}{g}\ .\ 4\ .\ 0{,}7071R\left(\frac{\pi n}{60}\right)^2$$

which does not agree with the above result; but if we take the radius of the circle of the center of gravitation we have

$$c=\frac{A+B}{g\ .\ \frac{R}{2}}\left(\frac{2.\frac{R}{2}\ .\ \pi\ .\ n}{60}\right)^2$$

$$=\frac{2B}{g}\ .\ 4\ .\ \frac{R}{2}\left(\frac{\pi\ .\ n}{60}\right)^2$$

which formula does agree with the one found above.

These deductions are probably too abstract to be understood by most of your readers. My object in writing to you is principally for the purpose of preventing a further spread of the above fallacy which I have found to be held by a great many mechanical engineers.

Yours truly,

Philadelphia, Pa. HUGO BILGRAM.

Projection of Drawings.

Editor American Machinist:

It is a good, general principle in warfare to meet your enemy with his own weapon, and any sarcasm in my second letter in answer to Mr. Oberlin Smith was indulged in in pursuance of this principle. I feel this acknowledgment due to Mr. Smith, who has shown himself to be a worthy and genial, as well as reasonable opponent, with whom it must be a pleasure to discuss any subject. In general, I prefer serious discussion and terseness of argument so as to arrive at the final result with the least delay; yet I cannot proceed to answer a few points in Mr. Smith's last letter without first acknowledging a good hit on his part—in speaking of the pinions of the gentle mosquito and the burrowing ardor of the prairie dog.

There seems no use in trying to prove any one method as being entirely in accordance with the natural appearance of objects, as in any such attempt we will be likely to meet with some absurdity, as has been sufficiently illustrated; and moreover the purpose of mechanical drawing is not to represent the object as it appears to the eye, but to show its various projections and sections in such a way that there can be no mistake about its shape and dimensions—the whole question being one of conventional agreement, and the real point to be arrived at, the adoption of a uniform method. Either that of the 1st or 3d angle, if universally agreed upon, would answer the purpose. I gave, however, in my first letter what I consider an important reason in favor of adopting the 3d angle method. Drawings are frequently left to be entirely or partially interpreted by workmen, who may have but crude ideas of the method of projection, and I believe what I said in my letter in No. 28, to be true, *i.e.*, "The workman judges everything by his practical experience, and since he must place his eye at a higher point, in order to look down on an object, than he must when viewing the front of it, he expects to find in the drawing the plan placed above the front elevation. In like manner, etc."

With this in mind, I think no complication can arise, such as Mr. Smith speaks of. In his letter, he says that probably a very large proportion of draughtsmen have never studied descriptive geometry. This is very true, and is the very reason why I suggested the imaginary transparent box to be used in setting the draughtsman's mind at rest when first getting up his drawing. Some guide should be furnished to secure uniformity. Here I would mention two additional arguments in favor of the 3d angle method, which Mr. Coleman Sellers, Jr., advances in a letter to me.

"1st. It is more convenient to have the elevations at the bottom of your drawing, because the elevations contain nearly all of the important dimensions, and must be consulted many times for each time that we refer to the plan."

"2nd. It is much more convenient to have the end elevation adjacent to the side it represents, both when making the drawing and when working to it. To project one end entirely across a long board is not only excessively inconvenient, but it is conducive to inaccuracy and requires more time."

As a general thing it is most convenient to set the first projection made, whichever it is, in the upper left-hand corner of the paper, and as was suggested to me by a civil engineer, this is the reason why in bridge work the vertical projection is always placed above the horizontal, the main thing being to determine the strain diagram. In machine work, however, a great deal depends upon the relative position of projections, and the matter of uniformity is more important in mechanical engineering than in any other profession in which draughting is employed. Mr. Smith's suggestion that this would be a proper question to be throroughly discussed by the A. S. M. E., is certainly a very good one, and I believe that the decision of this body would have great weight in bringing about the desired uniformity of practice.

Yours truly, A. FALKENAU.

Box 2,607, LEADVILLE, COL.

A New Screw Thread.

Editor American Machinist:

A general standard for screws is desirable. The system or plan of design should be every way unobjectionable; the best practical union of the most desirable qualities. The Franklin Institute system of thread has obtained the lead. It is more prevalent than any other, yet it appears to me to be so objectionable and unpractical that I feel almost like prophesying that it will never become universal, and I hope it will not, but that

confusion will reign till we have a national standard established by an authoritative convention. Here I should remark that I am a lay person uninterested in any system.

Here is my case against the F. I.: First as to size. The F. I. report left us to suppose that a one inch tap should be turned to one inch in diameter. Any way it gave us no other figures, and Tom, Dick, but not Harry, made them over size; some one size, some another, but Harry turned his taps to standard gauge. Tom and Dick having only common sense supposed they were spoiling their work if they turned taps to the gauge.

Now I believe screws ought to be turned standard size. I mean by that, that a one inch screw ought to be turned one inch, a ¾" screw ¾ of an inch, etc. I believe that a tap for rough iron, rolled to standard and no larger, should be of such a size as will not require the bolt to be unnecessarily reduced in strength by threading.

Can you take a lot of nuts threaded with taps turned to standard gauge and cut screws turned to standard gauge and get the nuts on without further reducing in size and cutting and fooling? You cannot, and the workmen in the shop where taps are turned to standard gauge turns his screws $\frac{1}{64}$ small by his rule, or spends three hour's time in doing 2 hours work. He also turns out some botch work by having all the bearing on the top of the thread.

The point I wish to urge is that screw threads should not bottom; that taps should be turned above the standard and screws standard; that every screw to follow taps turned to standard is $\frac{1}{64}$ of an inch needlessly reduced in size, and this is enough to make botch work of the whole business.

Look at two piles of bolts made from standard iron, one to tap turned to standard, the other to tap $\frac{1}{64}$ large. The eye instantly condemns the former as misproportioned and their rightful strength largely lost. It is a mistake to suppose that the reason why taps for rough bolts should be made large is because iron is sometimes rolled large. That is no proper reason. Taps should be made for standard iron and such taps must practically be made larger than the iron they are intended to be used for.

There are many engineers and bolt makers who will never consent to adopt your F. I. standard if that means taps turned to standard. One-sixty-fourth large for all screws over ½" is a common ground, best both for engineers and bolt makers on which they can meet in a universal standard.

There is one point on which objection may be raised against turning taps over standard, which is that holes have to be tapped through holes as where tap bolts are used. I have no hesitation in saying that body holes for tap bolts should be made one size larger on all accounts. The body is seldom for any good purpose required to fit, and should not except rarely when it could be fitted one size larger. The fine top of the F. I. tap rapidly wears off; one reason why taps should be made over size. Then the work being turned smaller, that is to standard size, the wear of the top is counted out as the thread does not bottom. This matter of fine points wearing brings me to my second charge against the threatened system, and I wish my old employer, who is getting up gauges for F. I., would turn his professors out to grass till the American Society of Mechanical Engineers has considered the subject of screws.

Go and stand at the lathe (or at the grindstone, for there is where you will be a good part of the time), and cut screws with a V tool. I mean small screws and big screws, especially big. You will find your point wears off provokingly fast, and if you are cutting a lot of screws as large as 1½" you will go and grind off the point of your tool to a flat of about ¼ of the pitch, and rough out the whole lot. Now go and look at your old taps, good everywhere except the tops or the points of the teeth, your old dies ditto. Then deny if you can that the impending thread is as utterly unpractical as the French Meter, the British Pound Sterling, or the universal flange coupling.

Look at the carriage bolt, a well-settled production. The manufacturer got sick of points wearing off and made threads without points. They are adapted to his mode of producing.

We must have something adapted to engine lathe work. The F. I. appears to be too exclusively an ink production. Now I have a profound respect for the best ink work; its results are wonderful.

But ink and grease, (the grease not too dry) beats every time. Where the grease is not fresh the machine may have about 90 points good and 10 points bad. I wish all pitches used finer than 4 were divisible by 2. You shall see, anon, why it could be so without disturbing symmetry too much. I suspect so. What is the use of running lathes backward? A relic of primitive clumsiness; but men will do it unless the nut drops pat in every time. Who is to blame if it does not? The F. I. half the time.

Our poor over-worked tool designers, after abandoning the screw thread for turning teed years ago, haven't discovered that small lathes should have 2 per inch pitch lead screws and large lathes 1 per inch. The latter matches on every thread in cutting all screws of integral pitch. The former on every thread on all even number pitches, and on every other thread (of lead screw), on all odd number pitches not fractional. With lead screws of these pitches there would be no excuse for reversing or stopping the lathe in screwing, but where work has on odd number pitch, a slight subterfuge is necessary, therefore it is desirable that odd number pitches be dropped when possible in the system of the future.

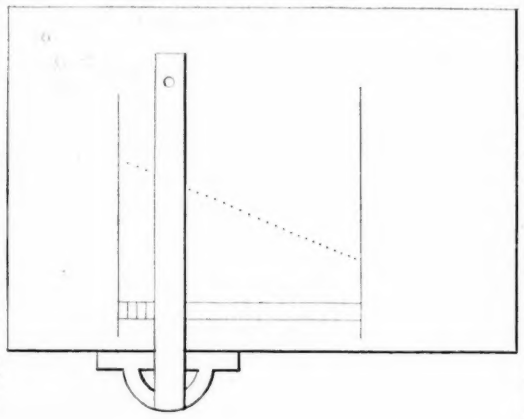
The sketch shows the result of the cogitation of your humble servant. Angle 75°.

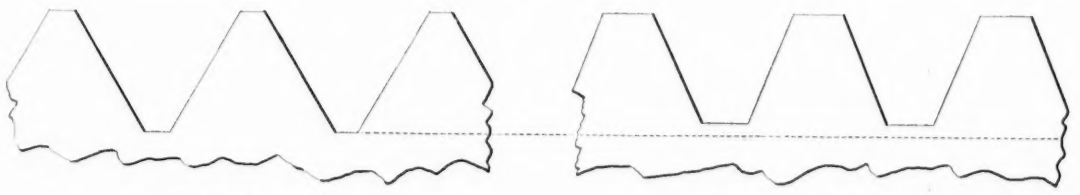
Is there anything better for iron wrought or cast, steel or brass? Its depth is about $\frac{1}{10}$ less on radius than the F. I., and its strong top is well adapted to cast iron.

Yours truly,

H. W. POND.

PHILADELPHIA, Dec. 13, 1880.





Franklin Inst. 60.° ⅛ Flat. Proposed. 75° ⅛ Flat.

One Inch Pitch. Full Size.

Method of Drawing Toothed Wheels.

Editor American Machinist:

The method usually employed in spacing toothed wheels is the "cut and try," with the dividers—a tedious and time-consuming process. Upon gears of less than 18" in diameter, the compass may be laid aside, and the following method used, with a saving of time and labor:

Take the case of a 5-inch ratchet wheel, with 36 teeth. Cut a straight strip or ribbon, an inch or less in width, of a good stout paper (manilla wrapping or detail paper answers admirably); wrap it around the blank pattern or form and draw it smooth; with a sharp knife or chisel cut off the ends *squarely* across, so they will just *meet;* remove the ribbon and tack it on the drawing board, a few inches from the edge and parallel thereto. With the T square erect *exactly* at each end of the strip, a vertical line, carrying it some distance above the paper.

The pitch of this wheel is $\frac{15.7}{36}$, and the nearest greater division on the common rule is the ½ inch. Lay one end of the rule on the board, at one line, swing the other diagonally across until the mark indicating 36½ inch divisions, exactly coinciding with the other line; then with a sharp, hard pencil, make a dot upon the board, along the rule, for each division. Take the T square, set the edge against the first dot, and draw a fine but distinct line across the paper tape; then take the second dot and draw another line; so proceed until all the points are projected upon the paper. Replace the strip upon the pattern, and fasten, at intervals, with tacks, or if it is metal, with a few drops of cold or thick glue. The spaces may now be pricked through the lines, or set off on the edge, with an awl or knife. The operation is simple, expeditious and very accurate, and has a variety of uses—laying out racks or segments, gear, ratchet, rag, or sproket wheels, and mortices in hubs, or other curved bodies. A small dial plate may be spaced this way, by fastening a turned block of seasoned wood to the back of the plate, and hanging to the live spindle of the lathe, as shown in the AMERICAN MACHINIST a short time ago, using of course, a new strip for each circle of holes.

Care must be taken not to alter the hygrometric condition of the paper, as that will lengthen or shorten it, and render it useless.

D. A. McC.

Detroit, Mich., Dec. 20th, 1880.

Plumbago for Lubrication.

Editor American Machinist:

In your issue of January 1st., Mr. Cleveland, the President of the Dixon Crucible Company, has taken exceptions to my communication of Oct. 16, entitled "Plumbago as a Lubricator," in which I described a certain machine for powdering the said article, and I may add its destruction for want of lubrication. Since Mr. Cleveland says that, so far as his knowledge goes of the mineral, that it has never yet been produced from any mine of sufficient purity for lubricating purposes, I don't wonder of persons fighting shy of it, who wanted it for that purpose. What I know about plumbago can be disposed of in a few words, viz: that I never want to repeat my experience in its preparation. Now, if Mr. C., will inform the readers of the AMERICAN MACHINIST how they shall be able to judge plumbago when offered for sale to them for lubricating purposes I, for one, shall be exceedingly glad to know it. Previous to and at the time that I wrote the article describing its use in a steam cylinder, I used all the influence I possessed to induce others to try it for the same purpose, but I never made one permanent convert that I know of. A gentleman from a distance came to see me, having seen the account of my experience with it. He said that if it would give him the same measure of success it had given me, it would go far towards solving a mechanical problem he was endeavoring to unravel. I never heard from him since, and am, therefore, in ignorance about the result. Another, living nearly 2000 miles from here, wrote me desiring all the information I could give him on the subject, and where he could get the right article. I gladly wrote him giving all the necessary particulars as to its use, and where he ought to be able to get what he wanted, and desired him to let me know the results; but no information has yet reached me. I mention this to endeavor to show Mr. Cleveland that there are a great many people who would like to know if plumbago will lubricate the piston, cylinder and valves of a steam engine.

Does the Dixon Crucible Company lubricate their steam cylinder with it? If so, will they please tell your readers the size of engine, kind, speed of piston, pressure of steam, load and such other information as would be of value to all who have an interest in the steam engine? Do they lubricate their fly shaft or their line shafting with it? If so, will they give your readers such information as will be of value to the mechanical engineer, to enable him to arrive at a just determination of the value of plumbago as a general lubricator? Superior as the present cylinder oils are to tallow and animal oils used for that purpose in former days, so would plumbago be above the present oils now in use. From present indications, the steam engine of the future is going to be one of high speed. Already 700 and 800 feet piston speed is being attained, per minute, and 1,000 feet are talked of. Anything that will lessen the friction of moving parts will be readily taken hold of. The day is probably not far distant when steam pressures will be used far in excess of the present practice. That will make cylinder lubrication even a more important question than it always has been. The question of lubrication and the immense loss of power by friction of journals and sliding parts, has been frequently presented in the AMERICAN MACHINIST. If plumbago is the article to reduce friction to a greater extent than the lubricants now generally known and used, the fact ought to be made known. As the Dixon Crucible Company have the means and the knowledge to prepare plumbago as a lubricant, I would suggest to Mr. Cleveland that he institute a series of experiments in their works, with their machinery, giving all the data necessary to form an intelligent opinion upon the subject. Knowledge from actual experience in everyday practice is very scarce, and is just the thing desired by the practical man, and valued when obtained. Such time or expense as may be consumed in carrying out the idea suggested, will not fall on barren ground. But we must have something more than a mere assertion that it will do thus and so.

WM. J. WILLIAMS.

Philadelphia, Pa.

General Orders were issued by the Secretary of the Navy, December 6, stating that the provisions of General Order No. 251, dated June 30, 1880, abolishing the rate of machinist in the Navy, and of General Order No. 255, dated December 2, 1880, explanatory thereof, shall not apply to machinists employed on board vessels of the Coast Survey and Fish Commission, and men will be enlisted in that rating as heretofore for such special service. The order referred to is modified so as to read as follows: "The following rates as substitutes for machinists and coppersmiths are hereby established in the Navy, as a part of the complement of the engineer force on all steam vessels of war when commissioned for sea service, or when employed as cruising training ships, viz.: finisher, boilermaker, and blacksmith, at a uniform pay of $50 per month and the usual ration. Applicants for the above rates who are physically qualified shall be examined by an experienced engineer officer as to skill in their respective trades (when practicable this officer shall be a chief engineer), and upon his recommendation they shall be enlisted. The men filling these rates are not to be detailed for duty outside of the engine department except in case of great emergency."—*Army and Navy Journal.*

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NEW YORK, JANUARY 15, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

Retrospective and Prospective.

In taking a retrospect of the mechanical progress of the year past, the almost inevitable tendency is to enlarge upon our advanced knowledge and achievements in mechanical engineering. We have very many bright pages in our history of mechanical progress, but it is better not to dwell too habitually upon these, as the contemplation of some of our less brilliant pages would doubtless contribute more to our practical advancement. One of the most satisfactory features of our substantial mechanical gain during 1880 is the increased interest manifested, by almost all classes of intelligent individuals, in the principles and application of mechanism, and the willingness of those possessing valuable skill and information therein to freely impart it to others desiring to make use of the same. There has been a change in this respect, extending over several years past, at no other time being more palpable than during 1880. In times not very remote, it would have been thought next to impossible to induce any considerable number of experienced mechanical engineers in this country to form a society with a national scope, giving personal attention to the meetings of such an organization, and imparting their dearly acquired knowledge to those younger in the profession. Yet, the year 1880 witnessed the successful founding of such a society, and a most gratifying beginning of its active work. To influences such as these, are we to look for more extended mechanical triumphs in the future, brought about largely by an exchange of views and criticisms upon existing methods and constructions, through the medium of the technical press and in public assemblages for the purpose. Thus may improvements be made through pointing out where they are most needed.

Although our American machine tools are acknowledged to be superior to those of foreign make, there is abundant room for general improvement in this branch of industry. A very large proportion of shop tools are too frail for the work they are designed to accomplish. As set forth by Mr. Charles T. Porter: "It is curious to observe how ingenious tool makers have generally been in trying to avoid this quality of strength, and how deceptive an appearance, in this respect, many tools present."

It is difficult to turn out the best quality of work with tools that are deficient in solidity. Some, otherwise excellently designed tools, are almost spoiled by thinning the patterns beyond all reasonable limits. A little more cast iron, involving a comparatively small additional expense, would bring these tools up to proper strength and solidity. Why are our machinery warehouses cumbered up with such light and unstable tools? There is mistaken economy somewhere, for they sell for but little less than those that are strong and substantial.

The steam engine indicator is an instrument that is coming into extended demand, as the benefits of its employment are becoming better recognized. There is no style of indicator of any importance that is not made in this country, yet not a few engineers send to Europe to buy their instruments, in order to obtain those accurately made. There is no good reason why indicators should not be made as carefully and reliably in this country as anywhere in the world. It is due to our engineering progress that the year 1881 shall witness a decided advance in this direction.

A great many engine and machine builders claim to make the parts perfectly interchangeable, and a few of them do so. Parts of machines are sent out to supply those broken or worn out, with the assurance that they will fit accurately; yet when the fitting is done, chipping, filing or planing must be called into requisition, before the result is accomplished. Let there be either more accuracy in making interchangeable work, or less positive claims on the part of manufacturers.

Improvements may be made in weighing scales, by which they will retain their accuracy indefinitely, instead of gradually losing it while in use. Scales can and ought to be made, that will weigh a few grains or a hundred pounds, at will, without being impaired by the heavier loads. Such an enterprise ought to be a good commercial, as well as a mechanical venture.

A long list of needed improvements might be presented, but we will here dismiss the subject in hopeful anticipation of being called upon to chronicle some decided advances in the directions outlined above, before the close of the present year.

Winter Economies.

In every shop the advent of cold weather brings a change of conditions, which should suggest changes of method. In a recent number we commented to some extent upon the ventilation of workshops, and few subjects present a better field for economy at this season of the year. Aside from the effect of no ventilation or bad ventilation upon workmen and work, the improvement of a cumbrous or troublesome method of ventilating shops can be well regarded as an economy. Shops built on the lantern roof plan, for example, may be ventilated readily by suspending a strong iron shaft by ordinary hangers under the centre of the roof lengthwise of the shop, and attaching a stiff iron rod of equal length to each pivoted window on either side. The rods should then be attached to substantial iron arms fastened to the central shaft, but to insure the windows opening on both sides by the same motion, the two sets of arms must be hung at different angles. A simple rod connecting each way and attached to the central ventilating shaft at one end of the shop, can then easily be arranged to operate the entire ventilating apparatus by a single motion. This not only insures a comfortable, graduated ventilation for the whole shop, but a ventilation which is certain to be applied because economical of time and trouble. For shops not built in this way, different methods must be applied. There are many shops, it is safe to say, in which many men work daily with cold feet, or contract colds through chinks about doors and windows, or through gaping walls, in which timely weatherstripping and repairing would admit of systems of ventilation, that would be at once economical and subject to control.

The covering of steam pipes and surfaces, exposed to radiation to prevent wasteful loss of heat, is another direction in which a goodly measure of economy can be gained. Doubtless there are many shivering shops which let enough steam go to waste every winter to heat the entire establishment.

The proper housing, and covering of coal piles, is another item in a wise economy. Trying to burn decarbonized coal is anything but economical, from either a direct or indirect point of view. Sorting and sifting coal, and having it of proper size is another item of economy, which is applicable, not only to the winter, but to any other season.

An important point in winter economies would be such a regulation of working hours as would use the short days of winter to the best possible advantage. For want of such regulation, many shops lose odds and ends of time for each man employed, that, if figured up, would make an exceedingly respectable total. Proper arrangements for the lighting of the shop are also useful. The sort of economy which postpones lighting and forces each man in the shop to work in a dim, religious twilight for a quarter or half hour unnecessarily every day of winter is, to say the least, misplaced. Lighting arrangements which take up unnecessarily the time of each man, also, should be avoided.

Very often the general arrangement of a shop admits of a sensible variation at this season. Tools that can be placed to advantage in a certain location during the milder months could be differently placed in winter at a profit.

The care of shops on Sunday, too, is often a matter of some importance in winter, when pipes are liable to become frozen through stoppage of work or want of care.

Proper attention to changes of clothing on the part of workmen is of special value at this season. Many a good man ruins his health permanently by wearing clothing a few days too late in the fall.

But perhaps one of the most effective economies of this season, is to be found in encouraging the rational use of their evening leisure, on the part of foremen, workmen and apprentices. The habit of reading, for example, once formed by steady cultivation during a single winter, may lead to results of the greatest value, not only to the person most directly benefited, but to shop and shopmates.

A Request and an Explanation.

We always esteem it a favor when manufacturers of machinery, tools, or appliances, mail us their new circulars, photographs, or prints from engravings of the same. We take every precaution to keep well informed as to improvements in mechanical matters. Whenever selections are made of objects for illustration and review in the AMERICAN MACHINIST, *no charge is ever made for such publication. We have never sold our editorial opinions, never intend to do so,* and therefore have no price for illustrating or reviewing anybody's invention or production. This will answer, at once, many inquiries we are receiving almost every day.

The English Wool Exhibition.

In a recent issue we noted the favorable prospect before the coming Cotton Exhibition, likely to be held at Atlanta, Ga. The service, which these industrial exhibitions, if well managed, render to the growers and manufacturers of such staples as cotton and wool, and the machinery interests which are connected therewith, is one not easily overstated. A wool show is to be held at the Crystal Palace, London, England, from June to October, 1881, which can be made a medium of advancing American interests. There should be a good representation of our American woolen machinery, which is acknowledged to be in advance of the styles usually made in Europe. There are to be twelve departments in this exhibition, including every grade of woolen goods, machinery and tools, whether worked by hand or power.

Literary Notes.

JOHN SWINTON'S TRAVELS.—Current Views and Notes of Forty Days in France and England, 25c. G. W. Carleton & Co., New York.

This little pamphlet of about 50 pages contains more pithy and interesting information about the social, industrial and political situations in these two great nations of Europe than most large and cumbersome volumes of travels. It is written in the direct common-sense style, which distinguishes the well-known journalist, John Swinton.

Referring to the body of wage-workers of Paris, he says:

"I found them in their homes; mingled with them in their resorts; visited their meetings; and saw them at hundreds or thousands of the out-door cafes with which all parts of Paris are dotted. They did not seem to be nearly as much overworked as those of the English cities; you did not feel that they were unmanned by underfeeding; they were always lively and chatty, often gay and never discourteous. I saw nothing of drunkenness, but much drinking of light wines and too much of absinthe; they were prudent, economical, and cleanly; family morality had a strong hold upon them; there was a very high grade of intelligence among them; they were remarkably well versed in political questions, and interested in the administration of public affairs; and they were looking toward many improvements that promise to relieve the evils of their lot under the anarchy of modern life. These evils are yet many and grievous, and I do not say that their condition is by any means, in any way, what it ought properly to be. But if so much advancement has been made, there is every hope of far greater advancement under a Republic that comprehends its duties. The

frugality that you notice on all hands is striking. A man will make a fine and satisfactory meal on a bowl of soup, radishes and salt, a half loaf of bread, with half a bottle of wine; then he will roll his cigarette and talk politics like a Deputy—strong politics very often.

Vennor's Almanac for 1881 (American News Co., publisher's agent) is a pamphlet of nearly 100 pages, embracing not only the weather predictions of the celebrated Henry G. Vennor for every month in detail, but a fund of convenient information on forecasting the weather by observing beavers, woodchucks, and other animals; also records of meteorological observations. It is sold by newsdealers at 25 cents per copy.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) L. C., Harrisburg, Pa., asks some very pertinent questions, which will receive proper attention when he gives his name and address in full.

(2) E. E P., Alton, Iowa, asks: 1. What is called "running ahead" in stationary engines; *over* stroke from the cylinder, or *under* stroke from cylinder? *A.*—The term "running ahead," on horizontal engines, is understood among engineers to be synonymous with the term "running over," which means the crank moving from the cylinder while completing the upper half revolution. 2. I desire to take up the study of chemistry without the help of a teacher; can you inform me what books to read and the order in which they come? *A.*—We suggest that you procure a Manual of Elementary Chemistry, by Geo. Fownes, (American edition); also Lessons in Elementary Chemistry, Inorganic and Organic, new edition, by Prof. Roscoe. Both are valuable, and you should have them.

(3) J. F. J., Bethlehem, Pa., writes: 1. How many horse power would be required to drive a set of three high rolls, at once disregarding the amount of work performed by the rolls, in shaping pieces of steel, weighing seven tons apiece? The top roll has a pressure of seven tons, the middle roll has the pressure of its own weight, plus that of the top roll, or seven tons more, making fourteen tons in all, for the middle. The bottom roll has only seven tons, or its own weight. The journals are 15″ in diameter, and have bearing surfaces of 13 inches in length on each end of each roll, and run at a speed of fifty revolutions per minute. 2. How much more horse power would be required to drive a set of three high rolls, weighing twenty-two tons, each having the same supposition being made in this case, in regard to the pressure of each separate roll, as was made in the preceding problem, but the journals 28 inches in diameter, having a bearing surface of 19 inches on each end of each roll, running at a speed of 35 revolutions per minute? *A.*—We are not aware of any data ever being published that would be of service to us in working out the above problems. It is a case where the information could be easily obtained, but, for some unexplained reason, no one seems to have taken sufficient interest in the subject to try the necessary experiments. The matter could be worked out by the formula applying to friction, but it would only be an approximation, as two sets of rolls of the same dimensions, made by different manufacturers, would run with different expenditures of power, owing to the difference in workmanship. The best and most practical way to get at definite results, is to try experiments with rolls of the required size, now running in some mill. The data thus obtained are reliable, and the use of complicated formulas is avoided.

(4) E. H, New York, asks: Would you be kind enough to answer the following questions? 1. Suppose I have a charcoal fire, and place upon it a piece of cast steel; when red hot, I take it out and allow it to cool. 2. I have a coal (soft) fire, heating and cooling steel as in the first instance. 3. I have a hard coal fire, heating and cooling steel as in the first instance. 4. What action have these fuels on the cast steel? If any, do they soften or harden? *A.*—Bituminous and anthracite coals usually contain a certain percentage of sulphur, which has the effect of corroding and injuring steel, in proportion to the amount of sulphur contained, the manner of imparting the heat, also the intensity, besides the length of time the steel is in contact with the fire. So far as hardening, tempering, and annealing are concerned, these are controlled by the application of heat and manner of cooling, simply, and are very little influenced by the kind of fuel used.

(5) C. M. L., Brockport, N. Y., asks: 1. Would "Minifie's Mechanical Drawing" be a suitable text book for a beginner in machine drawing? *A.*—It would do very well, but there are better books published. We would advise you to procure a copy of the Machinists' and Engineers' Drawing Book, by Blackie & Son, which will give you a full course in drawing, with an abundance of practical knowledge. Get the late edition. 2. For the determination of minerals, which would be the best annalysis (for an amateur in mining country), Plattner's Blowpipe Analysis or Fresenius' Qualitative Chemical Analysis? *A.*—Fresenius stands high, and is good authority, but for practical use in a mining country Plattner's work is preferable on account of its plainness and practicability.

(6) F. W. F., Portsmouth, N. H., asks: Will you refer me to the best work on mechanical drawing for a beginner? A.—See answer to the preceding question.

BUSINESS SPECIALS.

50 cts. a line for each insertion under this head.

Notice.—Alden Ore Crushers and Pulverizers, unequaled for efficiency and economy, $45 to $850, manufactured and sold only by Farrelly Alden, Patentee, Pittsburgh, Pa.

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Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

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Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

"Monitor Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton St., New York.

Wilkinson & Crowell, No. 506 Walnut St., Philadelphia. "Paragon" Piston-rod Packing, entirely metallic, automatic, frictionless, and practically free of steam pressure. Will work on high-speed or condensing Engines.

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Thomas D. Stetson, Patent Solicitor and Expert in Patent Cases, No. 23 Murray Street, New York.

See Christiana Machine Co.'s adver., on page 11.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

Howard S. Abbot, Attorney at Law and Solicitor of Patents, 617 7th Street, N. W., Washington, D. C. Personal attention given to cases in Patent Office.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

MANUFACTURES.

All our manufacturing establishments, both iron and wood, except the Vulcan Works, are running full time, and most of them have orders that will carry them through January.—Chattanooga *Tradesman*.

Benj. Eastwood, Paterson, N. J., is full of work in his machine shop, and expects to enlarge before Spring. He has lately put in some new tools.

The Wharton Railroad Switch Company, Philadelphia, are building two quite extensive additions to their works, to accommodate the rapidly increasing volume of business.

Armington & Sims, Lawrence, Mass., have orders for three 200-horse-power high-speed engines; also one for a 75 horse-power, one for 40-horse-power, and one for 30-horse-power, and a number of orders for portable engines.

The Holyoke, Mass., City Foundry has been enlarged by an addition 12 by 40 feet in size, to the main building. The firm have postponed for a while their project of building a machine shop.

Towanda, Pa., is making a strenuous effort to get capitalists to build factories within or near her limits.

Whiskey is moving actively at Pittsburgh. Large quantities of whiskey are being taken out of bond in that district, the demand for fine grades have increased so greatly. All the distilleries are running, the first time in years.—Boston *Com. Bulletin*.

Myron Platt, Ticonderoga, Essex County, N. Y., now in the foundry business, intends to start a machine shop.

The Southern Nevada Railroad Company has filed articles of incorporation to build a narrow gauge road from Leddie, Nev., on the Nevada Central, six miles from Austin, to Grantsville, a distance of 70 miles. The capital stock is fixed at $700,000, and a sufficient amount has been subscribed to begin work at once.

It is proposed to build car works in Milwaukee, Wis. The capital stock desired for the new concern is $500,000, and a large part of this amount is said to be promised already.

Barker & Berton, 422 East 23d St., New York, are setting two 5x22 feet boilers for Gaff, Fleishmann & Co., with the Jarvis furnaces, also one boiler 6½x16 feet, for Rubsam & Horrmann's brewery, and one for Levy Bros., New York.

The Brush Electric Light Company are about to put in two more boilers, set on the Jarvis plan, to furnish more steam for their lighting station in New York City, to burn screenings without a blower. The station is at 133 West 25th street.

The new Pacific Elevator in Brooklyn, N. Y., has been fitted up with the best mechanical appliances. They have two Buckeye engines, and their furnaces are fitted with the Mahony corrugated grate bar.

It is stated by the government engineer, that extensive beds of lignite are found on the Northern Pacific Railway, in Dakota and Montana, furnishing a fuel available for all domestic purposes. The company is now using the fuel in their locomotives, mixed in equal quantities with other coal. It is believed that with a modified form of fire box, similar to that now being introduced on some eastern roads, this fuel can be used without admixture with any other.

In the United States District Court at Chicago, Dec. 16, Judge Blodgett, in the suit of Washburn & Moen, for infringment of the patent of Hunt & Glidden for barbed wire fencing, decided that the patents were valid. This is a very important case, as an enormous amount of fencing is used, largely by railroads, and there are several manufacturers.

There are so many inventions that "cannot get out of order" and "will last a lifetime," that anybody who shall discover something that will get out of order, and will only last long enough to be carried home will supply a long-felt want.—*Boston Transcript*.

Railroad companies are urged to do away with the forenoon and afternoon business, and mark their daily time tables up to twenty-four o'clock.

A new company has been organized in Detroit, Michigan, called the Detroit Novelty and Shuttle Company, to manufacture a patent shuttle. They are putting in tools to manufacture a thousand shuttles per day.

Teller Manufacturing Company, Cleveland, Ohio, are building the tools and buying the machinery to manufacture a new sewing machine, said to be the lightest running machine in America.

The Citizens' Steam Supply Company, Lynn, Mass., are setting ten boilers made by the Whittier Machine Company of Boston. They are 5½′×16′ and will be set with the Jarvis Furnace to burn cheap fuel, like Nova Scotia culm coal, anthracite screenings, leather chips and wet peat.

A. F. Smith, shoe manufacturer, Lynn, Mass., has purchased a Lawrence high speed engine. He will take his steam from the steam heating company over a mile from his factory.

The Armory Mill, Manchester, N. H., has just set a new boiler with the Jarvis Furnace. It was made by Richard Dobbins of Lowell.

Davis & Furber, North Andover, Mass., have ordered a Lawrence engine for their machine shop.

Mr. Charles T. Porter has just ordered a pair of Tabor Indicators from the Ashcroft Manufacturing Company, with a full set of springs to use on his high speed steam engines.

Cox & Prentiss, Cleveland, Ohio, have added three thousand dollars worth of new tools to their shop since last July. They inform us that during the past month they built, for the Brush Electric Light Company, the largest milling machine in the United States and that they are crowded with orders for machinery and tools.

There are fifteen leather-board mills in the State of Massachusetts, and about thirty in New England, and their aggregate daily capacity is 50 tons.

George B. Williams, Taunton, Mass., is breaking ground for a new tack factory.

Orders from Mexico are getting to be the mode in machinery circles.

The Westinghouse Air Brake Company, of Pittsburgh, are materially enlarging their present works.

The Fox Lake Coal Company, of Cleveland, Ohio, has been incorporated by John P. Barton and others.

The Peninsular Car Works, at Adrian, Mich., which have been idle for eight years, are again in operation.

Important improvements are being made by the New York and New England Railway Company in their round house at Boston. When completed, the outside diameter of the building will be 290 feet, and there will be room for 36 locomotives.

A steam forge company has been incorporated in Louisvile, Ky., for the manufacture of car axles, etc. Dr. Norvin Green, of the Western Union Telegraph Company, is president.

Crawfordsville, Ind., is discussing the water-works question, with view of obtaining a supply direct from springs located near that place.

The Joliet (Ill.) Steel Company are constructing on their own premises new machinery for the manufacture of Bessemer steel horse shoes.

The Hercules Iron Works, of Chicago, are engaged in building for the North Chicago Steel Company a Blowing engine of 1,000 horse power, of an entirely new design and embodying all the latest improvements. An indication of its size and capacity may be found in the fact that its crank shaft is 19 inches in diameter, and the weight of the fly wheel is 52 tons. They are also constructing three condensing engines, with 16-inch-bore steam cylinder, the air pump being 28 inches. They have just completed a 60-horse power engine for the Union Iron and Steel Company, Bridgeport, and received another order for an engine of the same size. The company have in course of construction some steam hammers of a capacity of 4,000 pounds each.

The steam traction engine is likely to become a feature in the German army.

When the new glass works at Streator, Ill., are completed, a project to establish bottle works will be started. There is a movement being made also to enlist outside capital in establishing extensive zinc works.

D. P. Eels and other Cleveland capitalists have purchased the Bucyrus, Ohio, Machine Works, and will convert it into a car castings manufactory.

Newly-Incorporated New York Companies.

The Sedgewick & Stuart Manufacturing Company, Poughkeepsie. Alonzo Sedgewick, Robert James Stuart and others, incorporators; Capital, $20,000, in shares of $100 each, for the manufacture and sale of machinery and tools of all and every kind. December 22.

The New York Corrugated Soap Company, New York. Wm. A. Stewart, John D. Safford and others, incorporators; Capital, $200,000, in shares of $25 each; for the manufacture and sale of soap, oil, and petroleum products. Dec. 24, 1880.

The Consumers Gas Company of New York and Newark, N. J. Halsted C. Burnet, Albert D. Cowles and others, incorporators; Capital, $10,000, in shares of $10 each; for the manufacture and sale of machines and appliances to regulate the consumption of illuminating gas. December 27.

The Benton Manufacturing Company of New York. John B. Benton, Timothy Cornwell and others, incorporators; Capital, $25,000, in shares of $100 each; for the manufacture and sale of indicators and registers, and general machine work. December 27.

The Central Lead Company (Limited), New York. Capital, $50,000 in cash, in shares of $50 each; Edward A. Le Roy, Oscar E. Schmidt, and others, incorporators; for the manufacture and sale of leaden pipes and sheet lead. Preliminary certificate filed December 27.

The New York Bottle Stopper Company, New York. George B. Post, Charles A. Post and others, incorporators; capital, $5,000, in shares of $10 each; for the manfacture and sale of bottle-stopping devices. December 27, 1880.

The New York File and Manufacturing Company, New York. George T. Hope, George W. Lane, Jr., and others, incorporators; Capital, $10,000, in shares of $25 each; for the manufacture and sale of temporary binders for books, pamphlets, letters, photographs, music, and other papers. December 28, 1880.

Machinists' and Engineers' Supplies.

NEW YORK, Dec. 30, 1880.

The supply market remains unchanged, the dealers and manufacturers being engaged in taking stock and in getting ready for a good year's business. Prices also are unchanged.

W. F. & John Barnes, Rockford, Ill., have just issued a new illustrate dcatalogue and price list of 52 pages containing descriptions of some new devices for applying power to foot lathes, also lathes, saws and other miscellaneous tools made by the firm named.

The demand for taps and dies continues to increase.

The manufacturers of machine tools and steam engines all over the country report that they are working to their full capacity.

The business heretofore conducted under the firm name of A. F. Prentice & Co., of Worcester, Mass., will hereafter be transacted under the name of F. E. Reed, for some time past the sole proprietor.

Iron and Metal Review.

NEW YORK, December 30, 1880.

The pig iron trade is quiet, and without material change in prices. No. 1 Foundry, $25; No. 2, $21, and forge, $20. Prices of manufactured iron are steady, as follows:

American Iron Rails, $50 to $53, according to weight; Fish Plates, 2½c. per lb.; Railway Spikes, 3c.; Bolts and Nuts, 3½c.; Common Bar Iron, 2.3c., basis from store, Refined do. 2.5c., basis; Ulster, 3 6-10 basis; Machinery Steel, 6½c.; Best Tool Steel, 13¼c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6½c.; Nail Rods, 6¾c.; Sheet Iron, 3¼c., basis; Angle Iron, 3c; Tee Iron, 3½c.; Band Iron, 3 2-10c.; Hoop Iron, 3.5c., and up according to size; Horse Shoe Iron, 3 2-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

There is nothing new to note in the metal market.

WANTED

Wanted by the Southwark Foundry and Machine Co., Philadelphia, a number of first-class Fitters on Engine Work.

Wanted — Machinists. — Three strictly first-class Lathe hands, one draughtsman accustomed to Saw Mill machinery. Address D. J. Murray, Wausau, Wis.

Wanted.—Machinery for making Threshing Machine Spikes. Address A. M. H., care AMERICAN MACHINIST, 96 Fulton street, New York.

A mechanic, who thoroughly understands the steam engine and general machine and foundry business, will be open for engagement soon. Would prefer a small salary and interest in the success of the business. Address A. H. B., AMERICAN MACHINIST, 96 Fulton street, New York.

Wanted an assistant draughtsman and to keep in the office. A young man who has some practical knowledge, can make a reasonable elevation and plain figures, can hear of a situation by sending sample of drawing and writing to P. O. Box No. 16, Watsontown, Northumberland Co. Pa.

Wanted.—Experienced machinist skilled in scraping. Also a live pattern maker. Nordyke & Marmon Co., Indianapolis, Ind., builders improved Mill machinery, Portable Grinding mills, &c.

We desire to correspond with persons having clean copies of the following numbers of the AMERICAN MACHINIST which they are willing to dispose of: Vol. 1, Nos. 1, 2, 3, 9 and 11. Vol. 2. No. 2. American Machinist Publishing Co., 96 Fulton St, New York.

An Engineer well up in steam and steam engine, stationary or marine, wishes a situation. City reference given. Address J. Henshaw, 413 Second Avenue, N. Y. City.

Wanted.—A deserving and able young draughtsman wishes a permanent engagement. Best references furnished from previous employers. Address Bones, office AMERICAN MACHINIST, 96 Fulton St., New York.

Wanted.—A Mechanical Draughtsman desires a situation after Jan. 1, 1881. Has had many years experience in designing and constructing stationary and marine engines and boilers, steam pumping machinery and general work. Please address, Richard K. Pope, Brooklyn, E. D., New York.

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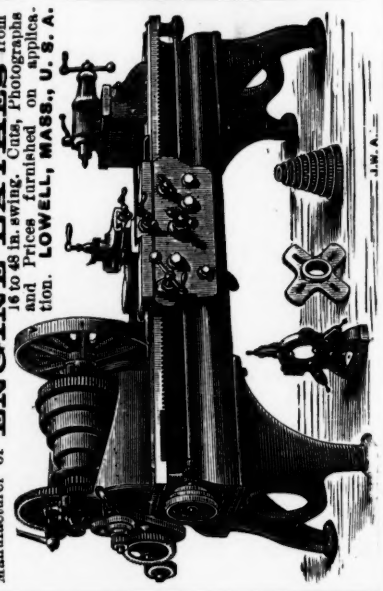

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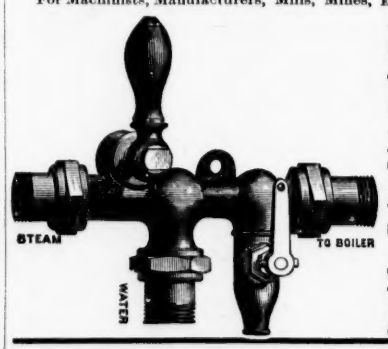

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Messrs. KEARNEY & FOOT, Brooklyn, N. Y., May 24th, 1877.

Gentlemen:—We have used your Files, more or less, for several years, and we take pleasure in saying that both the new and re-cut Files have given entire satisfaction. Yours truly,

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FARREL FOUNDRY AND MACHINE CO.

JAS. D. FOOT, Esq., Waterbury, Conn., Nov. 8th, 1878.

Dear Sir:—Please forward the order for Files given you a few days since.

Your Files have been uniformly satisfactory to us. Yours respectfully,

FARREL FOUNDRY & MACHINE CO., E. C. LEWIS, Ag't.

We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.

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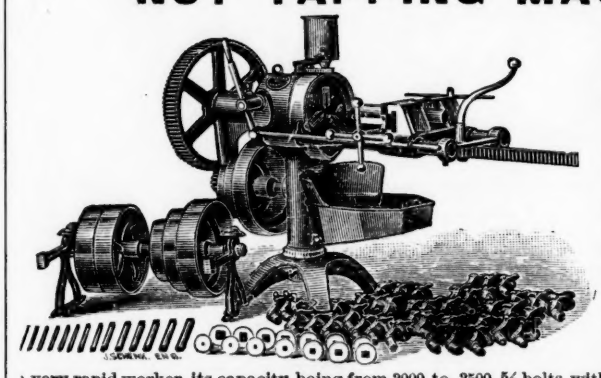

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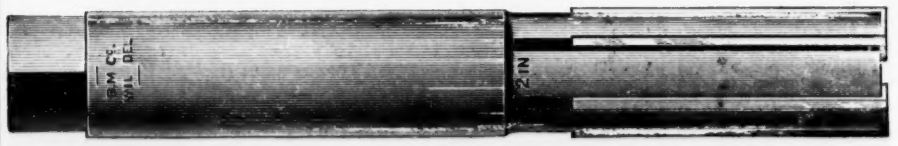

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